Chemistry
QC
790
U56

THE UNIVERSITY
OF MICHIGAN
OCT 16 1962
CHEMISTRY
LIBRARY

NUCLEAR SCIENCE ABSTRACTS

Volume 16 Number 18A

Abstracts 23352–25079

September 30, 1962

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, Public Library
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College

NORTH DAKOTA
Grand Forks, University of North Dakota

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library

OHIO (CONT.)
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State College
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennesse
Memphis, Public Library
Nashville, Joint University Libraries

TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

Volume 16, Number 18A September 30, 1962

NUCLEAR SCIENCE ABSTRACTS

A SEMIMONTHLY PUBLICATION OF THE DIVISION OF TECHNICAL INFORMATION, U. S. ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts is the only comprehensive abstracting and indexing service devoted solely to the literature of nuclear science and technology. Published twice each month since 1947, *NSA* provides coverage of (1) technical reports of the United States Atomic Energy Commission and its contractors; (2) technical reports of government agencies, universities, and industrial and independent research organizations in the United States and abroad, and (3) the book, patent, and journal literature, and translations thereof, on a world-wide basis.

INDEXES

Regular Issues. Each issue of *NSA* includes subject, personal and corporate author, and report number indexes. Report numbers are also indicated in the author and subject indexes. The author indexes include "short titles" of the items indexed. The Report Number Index provides information on the availability of the reports.

Cumulations. The indexes included in the individual issues are cumulated quarterly, semiannually, and annually. A cumulated report number, author, and subject index covering Volumes 1 through 4 (July 1948–1950) is included in the bound Volume 4 which is available from the Johnson Reprint Corporation, 111 Fifth Ave., New York, N. Y. ($30.00). A subject and author index covering Volumes 5 through 10 (1951–1956) is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($5.25).

A cumulative index covering Volumes 11–15 (1957–1961) was issued in early 1962 and is available from the U. S. Government Printing Office, Washington 25, D. C. ($40.25). The four parts of this cumulative index are also available separately as follows: Subject Index ($19.00), Personal Author Index ($14.25), Corporate Author Index ($2.50), and Report Number Index ($4.50). The Report Number Index covers all volumes of *NSA* and has been issued in lieu of report TID-4000, *Public Availability of Reports Abstracted in Nuclear Science Abstracts.*

HOW TO OBTAIN NSA

Subscription. The semimonthly abstract issues and the four cumulated-index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

- *Semimonthly issues.* Annual subscription rate: $22.00, domestic; $27.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.
- *Cumulated-index issues.* Annual subscription rate: $15.00, domestic; $17.50, foreign. Price per single copy varies according to the number of pages.
- *Domestic subscription rates* apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.
- *Foreign subscription rates* apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange. *NSA* is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

Availability to Government Agencies. *NSA* is available free of charge to all U. S. Government Agencies upon request to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Atomic Energy Commission reports is indicated in the Report Number Index. Also included, when known, is the availability of many reports of other government agencies and organizations, both in the United States and abroad.

The availability of certain unnumbered reports abstracted in *NSA* is included in the abstract. The abbreviation GPO indicates that the material is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Journal articles, books, and other published materials are available through standard commercial subscriptions or library sources.

Dissertations taken from *Dissertation Abstracts* are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan.

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

Use of funds for printing this publication has been approved by the Bureau of the Budget, July 29, 1960.

TABLE OF CONTENTS

Volume 16, Number 18A, September 30, 1962

Category	Page
GENERAL AND MISCELLANEOUS	3061
BIOLOGY AND MEDICINE	3063
General and Miscellaneous	3063
Biochemistry, Nutrition, and Toxicology	3064
Fallout and Ecology	3069
Radiation Effects on Living Tissues	3070
Radiation Sickness	3088
CHEMISTRY	3091
General and Miscellaneous	3091
Analytical Procedures	3105
General Inorganic and Physical Chemistry	3117
Radiation Chemistry and Radiochemistry	3125
Raw Materials and Feed Materials	3134
Separation Processes	3135
ENGINEERING AND EQUIPMENT	3138
General and Miscellaneous	3138
Heat Transfer and Fluid Flow	3140
Instrumentation	3143
Materials Testing	3159
GEOLOGY, MINERALOGY, AND METEOROLOGY	3162
HEALTH AND SAFETY	3166
INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS	3170
ISOTOPE SEPARATION	3176
MATHEMATICS AND COMPUTERS	3177
METALS, CERAMICS, AND OTHER MATERIALS	3179
General and Miscellaneous	3179
Corrosion	3181
Fabrication	3182
Properties and Structure	3184
Radiation Effects	3197
PHYSICS	3203
General and Miscellaneous	3203
Astrophysics and Cosmology	3224
Cosmic Radiation	3224
Criticality Studies	3226
Elementary Particles and Radiations	3226
Neutron Physics	3237
Nuclear Properties and Reactions	3239
Particle Accelerators	3252
Plasma Physics and Thermonuclear Processes	3254
Shielding	3257
Theoretical Physics	3258
REACTOR TECHNOLOGY	3261
General and Miscellaneous	3261
Power Reactors	3265
Research Reactors	3272
SPACE APPLICATIONS AND TECHNOLOGY	3275
WASTE DISPOSAL AND PROCESSING	3276
CORPORATE AUTHOR INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-9
SUBJECT INDEX	INDEX-42
REPORT NUMBER INDEX	INDEX-98

Volume 16, Number 18A September 30, 1962

NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

23352 (BNL-705) NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT, SEPTEMBER 1–DECEMBER 31, 1961. Jean H. Reynolds, ed. (Brookhaven National Lab., Upton, N. Y.). Mar. 1962. Contract [AT(30-2)-Gen-16]. 79p.

A summary is made of activities on reactor theory, experimental reactor physics, neutron cross sections, reactor evaluation and advanced design, chemistry, chemical technology, kinetics of columnar fused salt-liquid metal extractions, radiation engineering, and liquid metal heat transfer. Progress is also reported in isotope development, radiochemical analysis, hot laboratory operations, reactor metallurgy, alloy theory and nature of solids, radiation effects, graphite studies, and metallography. Mechanical engineering activities are reported on the High Flux Beam Reactor, experimental reactor physics, and radiation applications. (J.R.D.)

23353 (CF-57-2-1(Rev.1)) SYMBOLS FOR INSTRUMENT FLOWSHEETS AND DRAWINGS. A RECOMMENDED SYSTEM FOR APPLICATION TO ORNL INSTRUMENT WORK. R. K. Adams, D. G. Davis, R. F. Hyland, and B. Lieberman (Oak Ridge National Lab., Tenn.). June 19, 1962. Contract [W-7405-eng-26]. 30p.

Details concerning a recommended system of flow-plan symbols and drawings are given. The system is designed to identify the function of all major instrument components and to show schematically the operation of the instrument relative to the particular process. The system is used for identification and designation. (J.R.D.)

23354 (NP-11767) PROGRAM AND ABSTRACTS FOR THE FOURTH JAPAN CONFERENCE ON RADIOISOTOPES, OCTOBER 1961. (Japan Atomic Industrial Forum, Inc., Tokyo and Japan Radioisotope, Inc., Tokyo). 391p.

The program and abstracts for the 4th Japan Conference on Radioisotopes are presented. The 235 abstracts are grouped under the following topics: agriculture, biology, dosimetry, engineering, medicine, physics and chemistry, radiation chemistry, and safety and handling. (M.C.G.)

23355 (ORNL-3300(Vol.1)) PUBLICATIONS, REPORTS, AND PAPERS FOR 1961 FROM OAK RIDGE NATIONAL LABORATORY. (Oak Ridge National Lab., Tenn.). Contract W-7405-eng-26. 82p.

23356 (PNE-106P) GNOME POSTSHOT TEMPERATURE AND RADIATION STUDIES. Preliminary Report. Walter P. Bennett, Basil L. Smith, and Dale W. Roberts (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 1, 1962. Contract [W-7405-eng-48]. Project GNOME. 44p.

Temperature and radiation measurements in seven preshot and two postshot reentry drill holes are described. The data indicate the occurrence of large and rapid fluctuations in temperature in the postshot cavity during the measurements. During periods of relatively stable conditions, the temperature in the cavity void were uniform and approximately 95°C. A radiation log of one postshot drill sole run primarily to aid in side-wall sampling fixed the approximate upper cavity boundary. (auth)

23357 (PNE-109F) EARTH DEFORMATION FROM A NUCLEAR DETONATION IN SALT. R. B. Hoy and R. M. Foose (Stanford Research Inst., Menlo Park, Calif.). May 23, 1962. Contract [AT(04-3)-115]. Project GNOME. 58p.

Gnome, an underground test of a nuclear device, was located at a point 303 meters on a bearing N49°43'11"E from the center of Section 34, Township 23 South, Range 30 East, New Mexico Principal Meridian, at an elevation of about 674 meters referred to mean sea level or at a depth from the surface of 361 meters. This site is about 40 km southeast of Carlsbad, New Mexico, in salt beds of the Salado formation in the Delaware Basin. The topography, geology, and structure of the site are described. Theoretical calculations indicated that the effects of the Gnome nuclear explosion would result in a cavity 17 meters in radius and total tunnel collapse to a point 125 meters from the blast. Essentially no permanent displacement was expected in the shaft. Damage was not expected in the Shell gas well, 9.3 km distant; the potash mines, the nearest 13 km distant; nor in Carlsbad Caverns, 55 km distant. The theoretical maximum limit of displacement of a free particle at the surface was 3.035 meters. This was expected to develop fractures and visible permanent displacements. At the Gnome shot point a relatively stable cavity about 40 meters high was formed that could be used for underground storage of gas, petroleum, or waste products or to assist in mineral extraction. Surface effects from the explosion were minor, because the lithology, geologic structures, and topography were favorable for minimizing effects. The only potentially-dangerous effect of the deformation was the escape of radiation, and this could probably be prevented by additional stemming in the tunnel or by firing the shot in a vertical drill hole. It was concluded that nuclear detonations of 3 ± 1-kt yield can be fired in horizontally-layered salt without damaging shafts at distances of 400 or more meters, and a drift near a nuclear detonation in salt does not suffer total collapse as it does in tuff and granite and as it was theorized would happen to a point 125 meters from the shot point. It was also concluded that a 5-kt nuclear explosion

can be detonated in halite 200 meters under a water-bearing formation (aquifer) without so seriously fracturing both the upper part of the halite and the aquifer that water would penetrate downward to the cavity or to any part of the mine. The significantly different results between Gnome and Logan events, both having a yield of approximately 5-kt (Gnome 3 ± 1-kt), demonstrate that different environmental characteristics will almost certainly cause differing effects from nuclear explosions. There is a critical need to reduce the necessity for interpolation by increasing both empirical and theoretical knowledge by other experiments in different environments. The transient displacement at the surface, reported to be 1.5 meters, was just half the theoretical maximum limit of 3 meters estimated for displacement of a free particle at the surface. (C.H.)

23358 (TID-3711) INFORMAL LISTING OF BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE. Bibliographies Issued or in Progress During the Period, April–May 1962. (Division of Technical Information Extension, AEC). 32p.

The bibliography includes 180 entries. Subject and author indexes are included. (J.R.D.)

23359 (WT-360) AEC COMMUNAL SHELTER EVALUATION. Robert L. Corsbie (Atomic Energy Commission, Washington, D. C.). Mar. 1952. Project 9.1b [of] OPERATION BUSTER. 71p.

A test was conducted to determine the effects of several atomic explosions on a prototype shelter constructed of conventional materials, and buried under about three feet of earth. Details concerning construction, are discussed along with factors influencing the results, and the protection afforded. Conclusions are included concerning shelter resistance, protective value of the shelter and earth cover, and orientation of entrances. A design critique is also included. (J.R.D.)

23360 THE COMPETITION POSSIBILITIES OF NUCLEAR ENERGY FROM THE VIEWPOINT OF THE EUROPEAN ATOMIC INDUSTRY. Atom u. Strom, 8: No. 3, 17-21(Mar. 1962). (In German)

The competitiveness of nuclear energy with respect to traditional energy sources is reviewed. The selection of parameters for comparable basic units to be used in the calculation is discussed and criteria are presented. The actual current cost for various reactor types are given and compared with the cost of conventional power plants. (J.S.R.)

23361 DIE BEDEUTUNG DER WISSENSCHAFT FÜR DIE ENTWICKLUNGSLANDER. EINE AUSWAHL VON VORTRÄGEN UND REFERATEN, DIE AUF DER KONFERENZ "SCIENCE IN THE ADVANCEMENT OF NEW STATES" IN REHOVOTH (ISRAEL) IM AUGUST 1960 GEHALTEN WORDEN SIND. (The Importance of Science for Developing Lands. A Selection of Reports and Addresses which were given at the Conference "Science in the Advancement of New States" at Rehovoth, Israel in August 1960.) No. 3 of "Schriftenreihe des Bundesministers für Atomkernenertie und Wasserwirtschaft. Forschung und Bildung." Munich, Gersbach Sohn Verlag, 1961. 104p. DM 8.

A selection of reports and abstracts of reports given at the Conference on Science in the Advance of New States at Rehovoth, Israel in August 1960 is presented in German translation. Topics covered include: new science or old technology, the effects of physical knowledge on today's world, the economic outlook of atomic energy in new states, possible energy autarchy through nuclear reactors, solar energy research, economic aspects of scientific development, water supplies in dry regions, contributions of science and engineering to agrarian production and conservation of the fundamental resources of the soil and waters, cooperation in atomic research, problems of new states, the distillation of sea water as an essential supplement to the presence of naturally fresh water, the experience of Greece with the inauguration of scientific methods for the development of a political economy, sociology of new states, international work in the natural sciences, mental health and the development of new states, planning experimental cloud formations and their use in various regions, algae as food and their possible use as green manure in Japan, scientific management in the service of new states, use of modern scientific analysis and planning methods in the search for and working of petroleum deposits, modern epidemiology in the service of public sanitation, and medical research and new states. (M.C.G.)

BIOLOGY AND MEDICINE

General and Miscellaneous

Refer also to abstract 24561.

23362 MYOCARDIAL BLOOD FLOW DETERMINED WITH KRYPTON 85 IN UNANESTHETIZED DOGS. J. A. Herd, M. Hollenberg, G. D. Thorburn, H. H. Kopald, and A. C. Barger (Harvard Medical School, Boston). Am. J. Physiol., 203: 122-4(July 1962).

Serial, rapid measurements of left ventricular myocardial blood flow in trained, unanesthetized dogs have been made by injecting krypton-85 through chronically implanted coronary artery catheters and counting with an external scintillation detector. Precordial radioactivity declined as a single exponential function during the first 2 min after injection, suggesting a single rate of myocardial blood flow. Simultaneous estimations with Kr^{85} and blood flowmeters in acute experiments established the accuracy and reproducibility of the technique. Myocardial blood flows between 40 and 55 ml/100 g/min were observed repeatedly in three well-trained, unanesthetized dogs in the basal state. (auth)

23363 A NEW SPECIES OF SOIL-INHABITING MITE, HYPOASPIS MARKSI (Acarina, Laelaptidae). R. W. Strandtmann and D. A. Crossley, Jr. (Texas Technological Coll., Lubbock). J. Kansas Entomol. Soc., 35: 180-5 (Jan. 1962).

During a study of the soil arthropods inhabiting White Oak Lake bed, USAEC Controlled Reservation, Oak Ridge, Tennessee, several undescribed species of mites were found. One of these, a member of the genus Hypoaspis, was found often enough that a name for it became necessary. The characteristics of Hypoaspis marksi are described. (C.H.)

23364 CARBON DIOXIDE UPTAKE STUDIES IN ALGAE GROWN IN WATER AND DEUTERIUM OXIDE. Martin I. Blake (Univ. of Illinois, Chicago), Arlene S. Kaganove, and Joseph J. Katz. J. Pharm. Sci., 51: 375-9(Apr. 1962).

A procedure is described for studying carbon dioxide uptake in algae using C^{14}-labeled sodium bicarbonate as the source of carbon dioxide. Actively dividing, water grown and deuterium oxide adapted, Scenedesmus obliquus and Chlorella vulgaris were employed in the studies. Uptake comparisons were made over pH range 6 to 9 using appropriate buffer systems. Uptake was fairly constant in the range pH 6 to 8 for both the aqueous and deuterated algae. Above pH 8 uptake dropped markedly. In general, the deuterated algae showed between 10 and 30% lower uptake than ordinary algae. Greater chlorophyll content is associated with higher carbon dioxide uptake. (auth)

23365 GRAINS OF RADIOACTIVE PHOSPHORUS (^{32}P) AND THEIR EXPERIMENTAL USE FOR CLINICAL PURPOSES. M. Rameš and F. Morávek (Charles Univ., [Prague]). Neoplasma, 9: 159-76(1962). (In English)

For the study of histopathological changes produced by ionizing radiation in tissues and organs, the authors used grains of radioactive phosphorus P^{32} which they implanted by means of a puncture needle into the brain, testicles, lungs, muscular and subcutaneous tissues of 30 rabbits. The animals died or were sacrificed 24 hours to 117 days after implantation, the amount of P^{32} in the grains was 76 to 310 μc. Histological preparations from tissues and organs of the experimental animals permitted to follow the changes produced by beta radiation continuously from the maximal to minimal alterations. After experimental verification of their effect, the P^{32} grains were used for radiation hypophysectomy in 24 patients, for the greater part at an advanced stage of malignant neoplastic disease. The P^{32} grains which lose their consistency 10 to 14 days after application, and the radioactive substance become homogeneously dispersed in the tissue of the pituitary, give a promising hope of obviating the difficulties associated with correct localization of the grains using the stereotactic method of the implantation of radioisotopes in the hypophysis. (auth)

23366 EDUCATIONAL CONCEPTS IN NUCLEAR MEDICINE — PRESENT AND FUTURE. Lee E. Farr (Brookhaven National Lab., Upton, N. Y.). Northwest Med., 59: 1526-32(Dec. 1960). (BNL-4931)

The impact of radiation upon medical education is discussed. The comprehension that atomic energy requires of a physician today and particularly tomorrow is considered as comprising two categories: The first of these is described as technical knowledge of the field, such as the nature of radiation, the biological effects of radiation exposure, the computation of radiation exposure, and the evaluation and management of a radiation casualty whether it be mild or severe. The other category is medical background picture in which these new technical forces are brought into play. How these points might affect medical education is stressed. (P.C.H.)

23367 THE INCORPORATION OF TRITIATED THYMIDINE INTO THE DNA OF HUMAN BREAST TUMORS IN VITRO. Howard H. Sky-Peck and Frank R. Hendrickson. Presbyterian-St. Luke's Hosp. Med. Bull., 1: No. 1, 19-24 (June 1, 1962).

A technique is described for use in the pre-clinical screening of potential chemo-therapeutic agents in human neoplasms. Preliminary results indicate that needle biopsy is practical for obtaining tissue samples for studies on the effects of chemotherapeutic agents and radiation on the synthesis of desoxyribonucleic acids in tumor tissues. Results are reported from studies on the incorporation of thymidine-H^3 into the desoxyribonucleic acid of breast cancer and the effects of estradiol therapy on the uptake of formate and thymidine in tumor tissues. The effects of x irradiation on the incorporation of tritiated thymidine into tumor desoxyribonucleic acid were also studied. Data are tabulated. (C.H.)

23368 THE APPLICATION OF RADIOACTIVE GAS IN THE DETECTION AND QUANTIFICATION OF LEFT-TO-RIGHT CARDIAC SHUNTS. Mark H. Wholey, James H. Walker, John M. Hartman, and John Haskin (Charleston Memorial Hospital, W. Va.). Radiology, 79: 51-7(July 1962).

Theoretically the application of a radioactive gas in tracer amounts for assessing cardiac shunts possesses the accuracy of indicator dilution techniques and a simplicity comparable to oxygen saturation methods. Metabolic changes will not influence the results, and the test can be performed in conjunction with oximetry or during angiocardiography with or without general anesthesia. Because of the sensitivity of the scintillation crystal used for detecting tracer amounts of radioactivity, it is very possible that small shunts overlooked by conventional oximetry are

more easily localized by the methyl iodide–131 gas. This was true in 3 instances of small interatrial septal defects studied. By this new method qualitative localization of the shunt is a simple procedure and an estimate of the volume shunt is also possible from objective analysis of the curve. Exact quantification of the shunt, however, is attended by mucosal absorption problems that need further clarification. For qualitative localization, the test can be done without any specialized equipment other than the conventional well counter to be found in all isotope departments, and the final results are available in approximately ten minutes. One hundred patients have been studied by this method with a diagnostic accuracy of 93 per cent. (auth)

23369 THE EFFICACY OF MUTATION BREEDING. Walton C. Gregory (North Carolina Agricultural Experiment Station, Raleigh). p.461-86 of "Mutation and Plant Breeding." NAS-NRC 891. 1961.

Factors that affect the efficacy of mutation breeding and data from which comparisons of efficacy may be drawn between hybridization and mutation as methods of generating genetic variance for purposes of selection are discussed. Results are reported from a mutation breeding program conducted with irradiated peanuts. Results support the thesis that the mutagenic action of radiation may be used for the induction of variability in quantitative characters. They also lend support to the hypothesis that certain species of plants are capable of absorbing relatively large doses of mutation without crossing the threshold of obvious phenotypic expression and that such mutation permits a response to selection sufficient to exceed the reduction in the mean fitness occasioned by the treatment. (C.H.)

Biochemistry, Nutrition, and Toxicology

Refer also to abstract 23871.

23370 (AERE-R-4035) BARIUM IN BONES AND FOODSTUFFS. E. H. Henderson, A. Parker, and M. S. W. Webb (United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England). May 1962. 10p.

Emission spectroscopy was used to determine the amount of barium and strontium in human bones. The barium content was found to be approximately 36 μg/g Ca compared with a value of 320 μg/g Ca for natural strontium in adults. Unlike strontium the barium content of bones does not increase with age and in this respect barium resembles radium. An approximate discrimination factor of 13 was calculated for barium with respect to calcium between the level in the diet and that in bones. (auth)

23371 (CEA-1994) L'OR-198 ET LE ROSE BENGALE MARQUÉ A L'IODE-131 DANS LE DIAGNOSTIC DES AFFECTIONS HÉPATOVÉSICULAIRES (THÈSE). (Gold-198 and Rose Bengal Marked with Iodine-131 in the Diagnostic of Hepatic Vesicular Affections (thesis)). Justin Manambelona Razafimalaza (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1961. 46p.

Submitted to Université, Paris.

Colloidal gold-198 makes clear images of hepatic parenchyma; the examination from different angles demonstrated the presence of pathologically inert regions, such as hydatic cysts, abscesses, or neoplasia. The study of the disappearance curve for the colloid, together with a measurement of the blood volume, makes it possible also to calculate the hepatic flow. Using Rose Bengal marked with iodine-131, it is possible to obtain images of the liver and bile ducts, and to follow the elimination of the dye in the intestines. The simultaneous recording of the disappearance curves for the blood and of the appearance of the dye in the intestines constitutes a useful working test which is particularly sensible for evaluating the permeability of the bile ducts and, to a certain degree, the site of an obstruction. (auth)

23372 (TID-7616) SIXTH ANNUAL MEETING ON BIO-ASSAY AND ANALYTICAL CHEMISTRY, OCTOBER 13-14, 1960, SANTA FE, NEW MEXICO. (Sandia Corp., Albuquerque, N. Mex.). 235p.

Eighteen papers are included; separate abstracts have been prepared for 13. Five papers were previously abstracted in NSA. (P.C.H.)

23373 (TID-7616(p.3-38)) RADIOACTIVITY DISTRIBUTIONS IN THE METALLURGICAL PROCESSING OF THORIUM. R. E. Cofield (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.).

Radioactivity distribution patterns produced in the metallurgical processing (particularly casting by consumable arc melting) of thorium metal were studied. Samples from various locations in the metal, from material deposited on process equipment and from process area environmental sampling, were subjected to gross counting, alpha and gamma spectrometry, and growth-decay studies. Separation of thorium and radium and the release of thoron gas are the two important effects observed. A simple gamma spectrometry photopeak ratio method for determining the enrichment or depletion of radium in thorium samples, along with its calibration, is described. The data indicate extensive removal of the radium daughters from thorium in arc-melting, two successive arc-meltings removing essentially all of the Ra^{228}. The radiological hazard and analysis implications of these radioactivity distribution patterns are discussed. (auth)

23374 (TID-7616(p.39-50)) URINALYSIS FOR CURIUM BY ELECTRODEPOSITION. Isabelle Dupzyk and Max W. Biggs (California. Univ., Livermore. Lawrence Radiation Lab.).

A urinalysis method was developed for the determination of curium by electrodeposition. The urine is wet ashed, and the curium coprecipitated with bismuth phosphate, then lanthanum fluoride, and finally lanthanum hydroxide. The curium is separated from the lanthanum carrier using Dowex-50 colloidal ion exchange resin. Electrodeposition on a stainless steel or platinum disc gives a uniform film suitable for pulse-height analysis or low-background proportional counting. Final analysis of weak samples is done by radioautography. Curium recoveries of approximately 45% are obtained. Quantities of the order of 0.2 dpm can be detected by this method. (auth)

23375 (TID-7616(p.51-9)) EVALUATION OF ANALYTICAL METHODS FOR NEPTUNIUM^{237} WITH REGARD TO THEIR APPLICATION IN THE ANALYSIS OF HUMAN URINE. J. A. Miller (Union Carbide Nuclear Co. Paducah Plant, Ky.).

Four procedures for the determination of Np^{237} in human urine are described, as well as the format by which each procedure was evaluated. The four methods are: anion exchange on Dowex 1 in the nitrate form; anion exchange on Dowex 2 in the chloride form; coprecipitation of Np, Am, Cm, Pu, and Th with lanthanum fluoride; and extraction of

Np by thenoyltrifluoroacetone-xylene. It was found that the coprecipitation procedure has sufficient merit, 70% recovery as opposed to less than 20% recovery with the other three methods, to justify further consideration. (P.C.H.)

23376 (TID-7616(p.61-8)) PHYSIOLOGICAL INDICES OF STRAIN. M. L. Riedesel (New Mexico. Univ., Albuquerque).

A review is given on the understanding of stress and strain relations in biological systems. Consideration is also given to tolerance and duration. Special attention is given to the responses to heat exposure, which is reduced to workable dimensions. The causative agent is the heat load imposed on man by the environment plus the metabolic heat produced by the man. These factors are quantitated by the measurements and calculations of heat exchange by radiation convection, heat gain by metabolism, heat loss by evaporation, and heat strain. (P.C.H.)

23377 (TID-7616(p.69-77)) METHODS OF MAKING NEUTRON FLUX AND SPECTRA MEASUREMENTS IN A REACTOR. Kent C. Humpherys (Sandia Corp., Albuquerque, N. Mex.).

The type of perturbation produced in a fission spectrum by various moderating and shielding materials is discussed and typical neutron spectra from several types of reactors are compared to a fission spectrum. Several methods for measuring neutron flux and energy spectra in a reactor are reviewed. These methods include photographic emulsions, proton recoil counters, solid-state devices, and radioactivation of materials. For most experimental work in a reactor where volume restrictions are great and the gamma dose rate is high, radioactivation provides the most satisfactory measuring tool. Special attention is given to this method of neutron flux and spectra measurement. Radioactivation reactions discussed are thermal neutron capture, resonance reactions, fission by thermal and high energy neutrons, and threshold charged particle (n,p and n,α) reactions. The analysis of the radioactivation data to give neutron fluxes and spectra is also discussed. (auth)

23378 (TID-7616(p.79-88)) ESTIMATION OF DEPTH DOSE FROM Pa^{234} BETA RAYS. R. C. Heatherton (National Lead Co. of Ohio, Cincinnati).

The measurement of depth dose from uranium beta radiation in tissue equivalent materials by film dosimetry methods is described. Measured doses were compared to calculated values obtained by a method described for surface dose from semiinfinite sources. The comparison between doses obtained by the two methods is good. The half-value thickness for absorption of UX2 beta rays appears to be about 110 milligrams per square centimeter. It is concluded the contribution of beta radiation from uranium sources to exposure of the eye lenses and gonads is probably less than 15% of the dose to the body surface. (auth)

23379 (TID-7616(p.89-97)) RADIOCHEMICAL ESTIMATION OF FAST NEUTRON DOSES IN MAN. D. F. Petersen, V. E. Mitchell, and W. H. Langham (Los Alamos Scientific Lab., N. Mex.).

Measurements were made of the phosphorus and sulfur content of hair from various anatomical locations. A large number of sulfur and phosphorus analyses were performed to establish whether the sulfur content of human hair varied sufficiently between individuals and with body distribution. Results indicate that the sulfur content of human hair is remarkably constant regardless of color, consistency, or body distribution. Phosphorus content was somewhat more variable, presumably due to contamination of the samples with varying amounts of epidermal debris. However, no cases were observed in which the phosphorus content exceeded 1.0% of the sulfur concentration, and it was concluded that except in extreme situations of spectrum degradation, phosphorus activation could be disregarded as a significant source of beta activity. The simplicity of the analytical method, the relatively small sample required, and almost universal availability of hair suggest this procedure as an additional biological parameter for determining first approximations of the neutron dose sustained by potential nuclear-critical accident victims. (P.C.H.)

23380 (TID-7616(p.99-100)) A REVIEW OF A TWO-YEAR URINARY URANIUM STUDY CONDUCTED ON OPERATORS OF A URANIUM SAMPLING PLANT. Richard H. Burr, Jr. (Mallinckrodt Chemical Works. Uranium Div., [Weldon Spring], Mo.).

Samples were collected weekly, on Monday Before Work and on Friday After Work, during the period January 1, 1958 through December 31, 1959, from plant operators involved in the sampling of normal uranium ore concentrates of approximately 70% uranium assay. During the years 1958 and 1959, the sampling plant operators were exposed to an average airborne uranium dust concentration (without respirators) and integrated on the basis of job dust studies, of 50 $\mu g\text{-}U/M^3$ of air. 2150 individual urine samples were collected and analyzed for uranium, in triplicate, utilizing the fluorimetric technique of analysis. Summarized data are presented covering comparison of operator urinary uranium concentrations, Monday samples vs Friday samples, the urinary uranium concentrations vs job integrated uranium concentrations in air. Operators were found to have an average urinary uranium concentration of 25 and 50 $\mu g/l$ in Monday Before Work and Friday After Work samples, respectively. A case covering an employee's exposure to airborne uranium dust, in which kidney trauma was evident, is discussed. A Urinary Uranium Sampling Program, based on conclusions drawn from the data, is presented. (auth)

23381 (TID-7616(p.127-32)) ENIGMA OF LABORATORY VS. FIELD EXPOSURES TO PLUTONIUM OXIDE. J. D. Shreve, Jr. (Sandia Lab., Albuquerque, N. Mex.).

Discussion is given on the contrast between field results and those from laboratory studies on plutonium uptake by lung and bone. The Test Group-57 enigma of laboratory versus field exposures to plutonium is considered as a case in point for the field as a laboratory and for as direct hazard simulation as possible with special attention to solubility factors of particulates where inhalation hazards are prime. Data on field results of the plutonium burden in various organs of dogs are given. (P.C.H.)

23382 (TID-7616(p.133-46)) THE LUNG MODEL. John B. Hursh (Rochester, N. Y. Univ. School of Medicine and Dentistry).

The lung model is considered in the light of present knowledge, and inquiry is made as to whether it might be usefully modified. Discussion is given on the deposition and clearance properties of the model, and distinction is made between soluble and insoluble clearance. Reasons are also given for objections to increasing the precision of the lung model by incorporating the particle size information. (P.C.H.)

23383 (TID-7616(p.147-75)) DETERMINATION OF RADIUM-226 AND THORIUM-230 IN MILL EFFLUENTS. Earl R. Ebersole, Alan Harbertson, J. Kenneth Flygare, Jr., and Claude W. Sill (Idaho Operations Office. Health and Safety Div., AEC).

A procedure was developed to overcome certain prob-

lems that are particularly acute in the analysis of mill effluents. Four requirements are given for the analytical determination of Th^{229}, Th^{232}, and Ra^{226} along with methods for sample preparation and the analytical procedure for the determination of each. The procedure was set up on theoretical considerations and is regarded as tentative. However, sufficient checking was completed to indicate that the procedure will undoubtedly be far superior to others. (P.C.H.)

23384 (TID-7616(p.211-21)) USE OF POLAROGRAPHY IN THE AIR ANALYSIS OF HALOGENATED HYDROCARBONS. T. L. Duffy (Argonne National Lab., Ill.).

The feasibility of using the polarographic method for the analysis of halogenated hydrocarbons in air samples were studied. Four common chlorinated hydrocarbons, CHI_3, CCl_4, C_2Cl_4, and C_2Cl_3H, were studied in the range of 40 to 100% of their Maximum Allowable Concentrations. Recoveries from standard air samples were greater than 90% in all cases. (P.C.H.)

23385 (TID-7616(p.223-34)) LABORATORY TESTS FOR THE REMOVAL OF SUSPENDED SOLIDS IN PROCESS WASTES. M. W. Boback and R. C. Heatherton (National Lead Co. of Ohio, Cincinnati).

The problem of suspended solids in liquid uranium refinery wastes discharged to the Miami River is discussed. Information gained in laboratory tests are reported, and data are presented to show the effectiveness of Separan addition in removing suspended solids. Waste water, is discharged to the Great Miami River. The waste consists of treated sewage, storm sewer run-off, and the liquid waste generated throughout the process of producing uranium metal from ore concentrates. Continuous samplers are operated on these three streams which are mixed before entering the river. A continuous sampler is also operated on the mixed effluent stream. Twenty-four hour composites from these samplers are analyzed, and a record of the analyses of the mixed effluent stream is sent to the Department of Health, State of Ohio. (auth)

23386 (UR-608) THE DISTRIBUTION AND EXCRETION OF ANTIMONY-124 CHLORIDE IN THE RAT FOLLOWING INHALATION. Dusan Djuric, Robert G. Thomas, and Randi Lie (Rochester, N. Y. Univ. Atomic Energy Project). Dec. 27, 1961. Contract W-7401-eng-49. 54p.

Two distribution-excretion studies were carried out on rats which were allowed to inhale an aerosol of antimony-124 trichloride. Two rabbits and one dog were administered intratracheally doses of the same compound. Results of the inhalation exposures show early loss from lung with a somewhat exponential loss of longer biological half-life (~100 days) after the twentieth day. Serial sacrifice and tissue distribution indicated primary sites of antimony concentration other than lung to be whole blood, spleen, heart, and other highly vascularized tissues. On a long range or a continuous exposure basis, the critical organ based strictly upon an antimony concentration would be the circulating blood, and primarily the red blood cells. The excretion data are not elaborate enough to enable a good clear-cut bioassay procedure. Whole body counting at a lapsed time after inhalation exposure to radioactive antimony isotopes apparently could be used as a method of estimating initial body burden (assuming such measurements could not be made at the time of exposure). After twenty days the body burden decreases (in the rat) according to a simple exponential function. Although antimony localizes greatly in red blood cells of the rat this is not evident in the rabbit or dog. (auth)

23387 (UR-611) REACTION OF THE URANYL ION WITH AMINO ACIDS. BIDENTATE CARBOXYLATE CHELATION. Isaac Feldman and Larysa Koval (Rochester, N. Y. Univ. Atomic Energy Project). May 18, 1962. Contract W-7401-eng-49. 22p.

Stability constants determined by the pH method for 1:1 complexes of the uranyl ion with acetate, acid succinate, aspartate and glutamate ions in acid solution at 25°C and $\mu = 0.2$ all have practically the same value, $\log_{10}K_1$ between 2.61 and 2.70. These results are interpreted as being due primarily to the fact that in each case complexing involves only bidentate carboxylate chelation, which produces significantly less steric hindrance than is present in either uncomplexed, hydrated uranyl ion or in other possible chelate structures. The concept of bidentate acetate chelation of the uranyl ion is also used to explain the apparent anomaly that pK_1 for the uranyl–acetate complex is as high as pK_1 for the uranyl–glycolate chelate. Precipitation studies from pH 3 to 8 indicate that both carboxyl and imidazole nitrogens are probably involved in protein binding of the uranyl ion, but that binding by alpha amino groups is insignificant, probably for steric reasons. (auth)

23388 THE EFFECTS OF DEUTERIUM OXIDE ON CERTAIN MICROÖRGANISMS. Rosalie De Giovanni (Columbia Univ., New York). Ann. N. Y. Acad. Sci., 84: 644-7 (Nov. 1960).

The growth of several strains of E. coli and B. subtilis was inhibited by the presence of D_2O; the degree of inhibition exhibited by each strain was specific. The addition of 0.5 per cent NaCl to the D_2O media decreased the inhibition of growth. A deuterium-resistant mutant was obtained from one strain of E. coli. The incorporation of deuterium induces not only phenotypic but also genotypic changes in microörganisms. The effects induced by deuterium depend, however, on the genotype of the strain. The isotope appears to be mutagenic for some strains and some loci but not for others. Various types of forward mutations were obtained in some of the bacterial strains tested and the frequency of backward mutation was increased in two strains exposed to deuterium. Thymine containing deuterium, possibly in its methyl group, is not capable of inducing any detectable changes in a thymine requiring mutant. Cells, grown in D_2O media and subsequently washed and irradiated in H_2O-saline, are more sensitive to ultraviolet irradiation than control cells. (auth)

23389 MOVEMENT OF SEVERAL RADIOACTIVE ISOTOPES IN PEPPERMINT USING A SPLIT ROOT TECHNIQUE. Robert William Rinne (Purdue Univ., Lafayette, Ind.). Dissertation Abstr., 22: 3361(Apr. 1962).

Studies were conducted with four objectives in mind: first, to point out the characteristics of a peppermint plant which make it ideally suited as a test plant for ion movement studies; second, to study the movement of several radioactive isotopes in a modified peppermint plant by feeding the isotopes to just two vascular bundles of the peppermint plant; third, to try and account for any gross differences in the movement of the radioactive isotopes used in the second portion of the study; fourth, to show the effects of varied phosphorus levels on the ultimate distribution of radioactive phosphorus in the peppermint plant. The first study showed that the peppermint plant can be modified to any number of oppositely paired leaves by removing the apical portion and the lateral shoots can be removed without influencing the basic pattern of ion movement in the plant. Also pointed out was the fact that any of the four main vascular bundles of the peppermint plant may be fed an isotope separately or in any combination.

In the second study three different patterns of movement were observed. The first pattern was distinct for iron-59, sulfur-35, zinc-65, and cobalt-60. These isotopes showed a distribution in the A′,B′ sections of the odd numbered leaves and in the A,A′ sections of the even numbered leaves. The second type of pattern was distinct for chlorine-36. Chlorine-36 was distributed mainly in the A′,B′ sections of the odd numbered leaves. Some lateral movement of the chlorine-36 did take place into the A,B sections of the odd numbered leaves. The distribution of the chlorine-36 was quite irregular into the even numbered leaves. The third pattern of movement was distinct for rubidium-86 and calcium-45. These two isotopes were distributed in the A,B and A′,B′ sections of the odd numbered leaves. The even numbered leaves also contained the isotopes throughout the A,B and A′,B′ sections. The third study pointed out that the distribution of the calcium-45 into the A and B sections of the odd numbered leaves observed in the second study was due to a lateral movement of the calcium-45 out of the vascular bundles to which it was fed and into the vascular bundles which were not fed. The calcium-45 moved laterally only in the internode tissue. The fourth study pointed out that phosphorus-32 can be induced to move laterally to a phosphorus deficient area in the peppermint plant.

23390 ISOCITRATASE: SUBSTRATE SPECIFICITIES AND TRITIUM INCORPORATION. Harlow Hoover Daron (Univ. of Illinois, Urbana). Dissertation Abstr., 22: 3370 (Apr. 1962).

Isocitratase catalyzes the reversible cleavage of isocitrate to yield succinate and glyoxylate, and is, therefore, one of a group of enzymes which catalyze aldol-type reactions. The present study is concerned with the mechanism of isocitratase action. The enzyme-catalyzed reaction was examined kinetically, and the possibility of an enzyme-catalyzed hydrogen exchange between medium and succinate was investigated. The effect of succinate and glyoxylate concentration on the rate of isocitrate formation was examined and the kinetic data compared with three mechanisms for reactions of the type $A \rightleftharpoons B + C$. Two of these were eliminated as possibilities on this basis. These data were consistent with a mechanism where stepwise dissociation of either succinate or glyoxylate from the enzyme-substrate complex occurs. On the basis of this mechanism, Michaelis constants for succinate and glyoxylate were calculated as 7.0×10^{-4} and 1.6×10^{-4} M. Other apparent dissociation constants calculated from these data are: K_{GS} = (E) (S) (G)/(ESG) = 7.4×10^{-6}, K_1 = (E) (S)/(ES) = 4.6×10^{-4}, and K_2 = (E) (G)/(EG) = 1.1×10^{-4}. Substrate analogues were tested as inhibitors and a cis configuration for enzyme-bound succinate is suggested since maleate, but not fumarate, is a competitive inhibitor of succinate at 6.67×10^{-4} M. At a concentration of 1.67×10^{-3} M, inhibition by maleate is partially non-competitive with respect to succinate which suggests binding to the glyoxylate site as well. Oxalate exhibits a strong inhibition which is partially released by increasing the concentration of succinate or glyoxylate. Maleamate and malonate show weak inhibition at concentrations of 1×10^{-2} M. No inhibition is found with either D- or L-aspartate or acetate. In addition to the previously reported cysteine and glutathione, sodium sulfide and, to a lesser extent, 2-mercaptoethanol were found to satisfy a sulfhydryl cofactor requirement. Sodium thioglycolate, sodium hydrosulfite, and ascorbic acid were unable to substitute for cysteine in this respect, and their addition to a reaction mixture containing cysteine resulted in inhibition. An isocitratase-catalyzed hydrogen exchange between tritiated water and succinate was not demonstrated in the absence of glyoxylate. If there is such an exchange, it is less than $1/2000$th of the rate obtained in the presence of glyoxylate. This reaction was also investigated using tritiated succinate and a non-enzymatic, autocatalytic tritium exchange was found, which was dependent on magnesium and further increased by the addition of protein. When the reaction was carried out in the presence of tritiated water, the greatest amount of tritium was incorporated into succinate when the complete reaction mixture was present. The omission of glyoxylate, magnesium, or cysteine reduced tritium incorporation to less than 20 per cent of that found in the complete system. Pyruvate and acetaldehyde were unable to replace glyoxylate in this respect. The rate of tritium incorporation was compared to the rate of isocitrate formation and an isotope effect of 6 to 15 was observed. Increasing the concentration of isocitrate, cysteine, or adding glyoxylate increased the rate of tritium incorporation relative to glyoxylate formation. The rate of tritium incorporation was compared to the rate of isocitrate formation. Isocitrate formation was 14 to 19 times faster than the rate of hydrogen incorporation, assuming no isotope effect. Assuming an isotope effect of the same magnitude found during isocitrate cleavage, the rate of isocitrate formation is only 1 to 3 times faster than the rate of hydrogen incorporation. Various mechanisms consistent with the kinetic and exchange data are discussed. A similarity of the mechanisms of isocitratase and condensing enzyme is suggested since neither catalyze a demonstrable hydrogen exchange reaction. This is in contrast to aldolase, which catalyzes such an exchange at a quantitatively significant rate.

23391 A COMPARATIVE STUDY ON IRON TURNOVERS WITH SPECIAL REFERENCE TO Hb. E-THALASSAEMIA USING SMALL DOSES OF Fe^{59}. S. Swarup (Indian Council of Medical Research, Calcutta), J. B. Chatterjea, P. Hosain, and F. Hosain. Indian J. Med. Research, 49: 256-61(Mar. 1961). (In English)

Several Hb. E-thalassemia and a few other cases of hematological interest were subjected to radio-iron tests using tracer doses of only 0.035 ± 0.005 μc/kg. of body-weight and gas-flow counter for assaying the radio-activity of the samples. Serum iron and hemoglobin iron concentrations; curves for plasma iron clearance and appearance of radio-iron in red cells, and the plasma iron and the red cell iron turnover rates were obtained by standard methods. The results showed an increased rate of plasma clearance but decreased utilization of iron by erythrocytes in Hb. E-thalassemia disease; plasma iron-clearance pattern was similar to iron deficiency anemia but the red cell radio-iron uptake pattern bore similarity to aplastic anemia. This suggests that ineffective erythropoiesis contributes significantly to the causation of anemia in Hb. E-thalassemia disease. (auth)

23392 ISOTOPES IN SOIL-PLANT NUTRITION STUDIES. Intern. At. Energy Agency Bull., 4: No. 3, 10-13(July 1962).

A summary is given of papers and discussions presented at the Symposium on Use of Radioisotopes in Soil-Plant Nutrition Studies in Bombay on Feb. 26 to March 2, 1962. Some of the topics discussed were soil chemistry, physical characteristics of soil, uptake and translocation of nutrients, measurement of available phosphorus, and fertilizer usage. (D.L.C.)

23393 INTERACTION OF MERCURY WITH HUMAN ERYTHROCYTES. R. Weed, J. Eber, and A. Rothstein (Univ. of Rochester, N. Y). J. Gen. Physiol., 45: 395-410 (Jan. 1962).

The binding of mercury to red blood cells was measured in terms of Hg^{203} uptake and desorption. The significant features of the binding are rapid achievement of equilibrium; release of a Hg-complexing material from the red cells themselves which distorts the binding curves at low concentrations of metal; prevention of binding by cysteine, glutathione, penicillamine, and EDTA but not by imidazole or histidine; binding of mercury in amounts up to 7 times the reduced glutathione concentration of the cells before combination with glutathione itself; and binding primarily to sulfhydryl groups of hemoglobin and to a small number of stromal sulfhydryl groups, but also to other non-sulfhydryl cellular ligands after saturation of the sulfhydryl groups. Associated with the binding is inhibition of glucose uptake, induction of loss of K^+, and decrease in osmotic fragility. These effects increase over the range of concentrations (1×10^{-17} to 1×10^{-15} moles of Hg/RBC) well below those that result in saturation of the cellular binding sites; above 1×10^{-15} moles/RBC, the effects decrease as the cells become saturated. (auth)

23394 POSSIBILITIES AND ACTUAL LIMITS FOR THE CALCULATION OF THE ACCRETION RATE OF BONE IN TRAUMATIC LESIONS OF THE VERTEBRAL COLUMN. P. Scoccianti (Università Florence). Minerva nucleare, 6: 82-5(Mar. 1962). (In Italian)

The results of external counting after intravenous administration of Sr^{85} in 10 cases of vertebral fractures are shown. The possibilities and limitations of this method in calculating the local bone accretion rate in spine fractures are discussed. (auth)

23395 RESEARCH ON THE HUMAN PULMONARY CIRCULATION BY MEANS OF CARDIAC CATHETERS AND RADIOACTIVE TRACERS. G. L. Turco, F. Ghemi, G. Segre, and A. Tarquini (Università Turin). Minerva nucleare, 6: 85-90(Mar. 1962). (In Italian)

In two patients with atrial septal defect it was possible to study with two catheters, one in the pulmonary artery and another one at the entrance of the pulmonary veins, the distribution curve P(t) of the pulmonary circulation times and its mean value. With this purpose albumin I^{131} was injected into the pulmonary artery and blood was sampled at the entrance of the pulmonary veins with simultaneous registration of the radiocardiography. The mean value of pulmonary circulation time was between 2.6 and 2.7 seconds. It was shown that the P(t) curve can be derived, with good approximation, from the radiocardiography obtained by injecting the tracer into the right ventricle. (auth)

23396 THE REMOVAL OF AMERICIUM AND PLUTONIUM FROM THE RAT BY CHELATING AGENTS. D. M. Taylor (Royal Cancer Hospital, London) and F. D. Sowby. Phys. in Med. Biol., 7: 83-91(July 1962).

The effect of treatment with a number of different chelating agents on the retention of plutonium or americium has been studied in rats. Diethylenetriaminepentaacetic acid (DTPA) was found to be the most effective reagent for the removal of both plutonium and americium. The effects of different times and patterns of treatment have been investigated and it has been shown that for both elements the greatest reduction in retention occurs when treatment is commenced very shortly after exposure. (auth)

23397 THE STABILITY OF INJECTED VITAMIN B_{12}–Co^{60} AND THE VITAMIN B_{12} CONTENT OF DOG LIVER. C. Rosenblum, D. A. Willigan, H. T. Meriwether, and E. P. Cronkite (Brookhaven National Lab., Upton, N. Y. and Merck Sharp and Dohme Research Labs., Rahway, N. J.). Proc. Soc. Exptl. Biol. Med., 105: 142-5(Oct. 1960). (BNL-4888)

An investigation was made of livers from 5 dogs receiving 3.6 to 14 μg (specific activity = 1 mc/mg) of vitamin B_{12}-Co^{60} intravenously. The vitamin B_{12}-Co^{60}, was retained by the livers as an intact cobalamin, probably as cyanocobalamin. This was demonstrated by the method of reverse isotope dilution. Direct isotope dilution indicated an average total cobalamin concentration of 0.36 μg/g of dog liver. The authenticity of retained vitamin B_{12}-Co^{60}, introduced by injection, as an isotope dilution tracer was demonstrated by simultaneous analysis with vitamin B_{12}-Co^{57}. Degradation of vitamin B_{12} to ionic cobalt was negligible. (auth)

23398 INTESTINAL ABSORPTION OF Ca-45 AND Sr-85 AS AFFECTED BY THE ALKALINE EARTHS AND pH. Frank R. Mraz (General Electric Co., Richland, Wash.). Proc. Soc. Exptl. Biol. Med., 110: 273-5(June 1962). (HW-SA-2519)

Using an in vivo perfusion technique, the absorption of Sr-85 and Ca-45 from the small intestine of the rat was observed to be influenced by the alkaline earths and pH. Addition of calcium or beryllium to the perfusate reduced Ca-45 absorption more than Sr-85 absorption. Magnesium and barium had a greater effect on Sr-85 than on Ca-45, while strontium reduced absorption of Ca-45 and Sr-85 to the same extent. Extremes in pH tended to increase the ratio of Sr-85 to Ca-45 absorption. (auth)

23399 IONIMETRIC EXPERIMENTAL RESEARCH IN TELECESIUM THERAPY. R. Miceli and C. Rimondi (Università, Bologna). Radiobiol. radioterap. e fis. med., (3) 16: 315-33(1961). (In Italian)

Results of further physico-dosimetric experiences on a 2000-c Cs^{137} unit are reported. Particular attention is given to findings referring to the electron scattered radiation of the diaphragm as well as the effects which the various technical factors of the treatment (diaphragm amplitude, diaphragm-measuring chamber distance, and filters) may bring to bear on this radiation. The transmission rates on depth referring to different target-surface distances are also submitted, with systematic comparison against those of cobalt therapy and 200 kv therapy. Such a comparison between radiations of different energy is carried to the measurement, in man, of the percentage dose emerging from different body parts. Isodose curves are shown in connection with the various technical parameters of the treatment. (auth)

23400 MEASUREMENT OF Hg^{203} CHLORMERODRIN ACCUMULATION BY THE KIDNEYS FOR DETECTION OF UNILATERAL RENAL DISEASE. Richard C. Reba, Henry N. Wagner, and John G. McAfee (Johns Hopkins Medical Inst., Baltimore). Radiology, 79: 134-5(July 1962).

A chlormerodrin uptake test is described for kidney function studies. Ten to 30 mc of Hg^{203}-chlormerodrin is injected intravenously and count rate from a γ spectrometer is recorded for 60 min. The scintillation crystals are located under the kidneys. The test is useful in selecting patients hypertensive because of unilateral renal ischemia. (T.R.H.)

23401 RADIOACTIVE SULFATE UPTAKE AND TURNOVER IN THE CHICK STOMACH. Léonard F. Bélanger and B. B. Migicovsky (Univ. of Ottawa). Rev. can. biol., 20: No. 4, 789-96(Dec. 1961). (In English)

The presence of radiosulfate has been revealed by radioautography in the mucous glands of the crop, in the superficial glands, and in the duct portion of the deep glands of the proventriculus; also in the superficial portion of the gizzard glands, and in the cuticle which covers the mucosa of this third pouch in the chick stomach. The sulfated mucopolysaccharides are apparently at the site

of the Golgi by a process of continuous secretion; the intracellular mucus is replaced within 6 hrs. The surface and pits of the proventriculus contain metachromatic mucus apparently not biosynthesized in this site. This material is Hale negative and more mature than that of the superficial glands underneath, which is Hale positive and presumably possesses unsaturated SO^4 groups. The superficial glands appear homologous to the isthmus of the mammalian fundic glands. The proventriculus-gizzard junction resembles the mammalian pyloric region in regards to the high sulfate uptake and to the histochemical staining of mucus. The cuticle of the gizzard contains stratified layers of sulfated mucopolysaccharides which are incorporated into it 6 hrs after the administration of tracer. The life span of this coat is 4 days under present conditions. The extracellular mucus of the cuticle is metachromatic and Hale positive like that of the glands underneath. (auth)

23402 STRONTIUM-90 IN REINDEER BONE. V-E. J. Virkkunen and A. P. U. Vuorinen (Inst. of Radiophysics, Helsinki, Finland). Suomen Kemistilehti, B35: 35-8(1962). (In English)

Values of the Sr^{90} and Cs^{137} contents of reindeer moss and the flesh and bones of reindeer determined during the winter 1958–59 are given. The theoretical basis of a simple chemical method for the determination of Sr^{90} in bone ash is presented. This method is particularly suitable when the contamination level is relatively high. (auth)

23403 CONTRIBUTION TO THE EXPERIMENTAL DETERMINATION OF TRACE METALS IN BIOLOGICAL MATERIAL BY ACTIVATION ANALYSIS BY THERMAL NEUTRONS. J. Pijck. Verhandel. Koninkl. Vlaam. Acad. Wetenschap. Belg., Kl. Wetenschap., 23: No. 67, 1-187 (1961). (In Flemish)

The results of experiments made to determine the behavior of Sb, As, Cr, Co, Au, Fe, Cu, Hg, Pb, Mn, Mo, V, Ag, and Zn in the form of traces during the destruction of biological material can be summarized as follows: Destruction by dry combustion is to be rejected as a general method. For the majority of the elements mentioned it is impossible to effect a quantitative recovery even at the relatively low temperatures 500 to 550°C. On the contrary by mineralizing organic substrates with the acid mixture HNO_3–$HClO_4$–H_2SO_4 (3 : 1 : 1), quantitative results could be obtained except for the elements Sb, As, Au, Fe, and Hg. For these the use of a reflux coolant is necessary. The examination of the interfering secondary reactions $Zn^{64}(n,p)Cu^{64}$, $Fe^{54}(n,\alpha)Cr^{51}$, and $Ni^{58}(n,p)Co^{58}$ was effected by irradiating Zn, Fe, and Ni samples in the thermal column of a reactor. From these experiments it could be concluded that the interference of these reactions is negligible for samples of serum under the irradiation conditions given. The neighboring elements Cu, Cr, Zn, and Co were determined in the blood by radioactivation. For Cu, Cr, and Co a selective quantitative separation method was used, based on either liquid-liquid extraction or selective distillation. On the contrary, for Zn, a more complex separation was necessary in which the yield was calculated by gravimetry or by titrimetry. The principal advantage of the method proposed consists in the considerable reduction in the size of the sample, which was of the order of 250 to 25 λ. (tr-auth)

23404 THE EFFECTS OF DEUTERIUM OXIDE ON BACTERIA. Rosalie de Giovanni (Columbia Univ., New York). Z. Vererbungslehre, 92: 389-402(1961). (In English)

The growth of several strains of bacteria was inhibited by D_2O-media. The degree of inhibition was strain specific. The incorporation of 0.5% NaCl (w/v) to the D_2O-medium decreased the inhibition of growth. No adaptation to better growth in deuterium was obtained in any of the strains tested; however a deuterium resistant mutant was obtained from one strain. Two strains tested formed enlarged, distorted cells when grown for more than eight generations in D_2O-media. Cells grown in D_2O-media and washed and resuspended in H_2O–0.85% NaCl (w/v), were up to sixty times more sensitive to ultraviolet irradiation than control cells. Deuterium induces the occurrence of forward mutants in some strains. Many loci, but not all, showed an increase in the back-mutation rate over the spontaneous level, indicating some specificity of action by deuterium. Deuterated bases, obtained from a strain grown in D_2O-medium, did not induce any phenotypic or genotypic effects when supplied to specific base-requiring strains. The amount of deuterium incorporated into the bacteria may be related to the mutagenic effect induced. The genotypic and phenotypic effects induced by deuterium are probably the result of an over-all isotope effect. (auth)

Fallout and Ecology

23405 (AD-269884) APPLICATION OF WEATHER RADAR TO FALLOUT PREDICTION. Quarterly Technical Report No. 14, June 1, 1961 through August 31, 1961. Pauline M. Austin (Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology). Sept. 15, 1961. Contract DA-36-039-SC-75030. 16p.

Special emphasis was placed on the observational program, the primary aims being to test the ability of the 10 cm radar to detect hail and to obtain data suitable for studying the variations in the vertical structure of convective storms during their lifetimes. Both objectives were accomplished. The cooperation of meteorologists associated with one of the local broadcasting stations provided hundreds of reports of hail occurrences. The agreement between the locations at which hail was reported and the tracks of high-intensity contours was excellent. (auth)

23406 (CEA-2131) ETUDE DE L'INFLUENCE DES FACTEURS CLIMATIQUES SUR L'ACCUMULATION DES RADIOELEMENTS DANS LES TISSUS VEGETAUX (THESES). (Study of the Influence of Climatic Factors on the Accumulation of Radioelements in Plant Tissue (thesis)). J. Gagnaire (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucleaires, Grenoble). 1962. 37p.

A method is proposed for treating soil to promote absorption and accumulation of radioisotopes in aerial parts of young trees. The treated young trees, appropriately selected, can be used to detect possible contamination of soil by a radioisotope during a whole vegetation cycle. The concentration power of tissues of these trees is considerable: after being cultivated on contaminated soil for only 4 weeks the concentration rate is about 85 in spruce-needles. Activity measurements of samples of plant tissues may become a routine process in control of soil contamination. (auth)

23407 (DASA-1302) SECOND QUARTERLY REPORT ON PROJECT STAR DUST.† James P. Friend and Herbert W. Feely (Isotopes, Inc., Westwood, N. J.). Nov. 1, 1961. Contract DA-49-146-XZ-079. 88p.

A Star Dust sampling corridor was established in the vicinity of the 98th meridian W., extending from 15°N to 48°N latitude. The results of radiochemical analyses of filter samples collected in this corridor between July 6 and September 28, 1961 and the results of gross activity meas-

urements of samples collected in the corridor between September 30 and November 1, 1961 are reported. Analyses of a few samples collected elsewhere are also included. Virtually all filters were included in a series of composite samples which were analyzed for the fission products Sr^{90} and Ce^{144}, for the tracer nuclides W^{181} and Rh^{102}, and for the natural nuclides Be^{7}, Pb^{210}, and Po^{210}. Some were also included in composite samples analyzed for Sr^{90}, Cs^{137}, and Pu. Detectable activities of W^{181} were not found and no results are yet available from the plutonium analyses. The highest concentrations of Sr^{90} from weapons tests before 1961 which were encountered in the Star Dust sampling corridor during late 1961 were found at the highest altitudes and highest latitudes sampled. A similar distribution of stratospheric Rh^{102} was found. This situation is basically the same as that which existed in the stratosphere during early 1960. The activity ratio Ce^{144}/Sr^{90} in debris was used to calculate the relative quantities of the debris which originated in the rocket shots and which originated in low altitude detonations. It appeared that almost 70% of this debris was produced by the rocket shots. This calculation was applied to data from samples collected during 1960 as well as to data from samples collected during 1961. Stratospheric burdens of Sr^{90} were calculated from the results. It appeared that the total stratospheric Sr^{90} burden during early 1960 was 1.0 Mc, of which 0.4 Mc was produced by the rocket shots and 0.6 Mc by low altitude detonations. Approximately 0.62 Mc of Sr^{90} was present in the stratosphere of the Northern Hemisphere during early 1960, 0.28 Mc derived from the rocket shots, and 0.34 derived from other sources. By late 1961, however, the stratospheric burden in the Northern Hemisphere had dropped to 0.35 Mc, 0.25 Mc from the rocket shots and 0.10 Mc from low altitude detonations. The distribution in the Star Dust sampling corridor during October 1961 of debris from the 1961 Soviet Tests was quite consistent with the characteristics of stratospheric mixing and transfer deduced from investigations of stratospheric radioactivity during the High Altitude Sampling Program. High concentrations of this Soviet debris spread as far south as 30°N within a month after its injection at high latitudes, but only low concentrations appear to have spread further southward into the tropical stratosphere (to 10°N) by the end of October 1961. Evidently meandering currents of the zonal circulation produced the rapid mixing to 30°N, for the highest concentrations found in the Star Dust sampling corridor were found near this latitude, and the "secondary maximum" in the distribution of debris which these represented (assuming the existence of a primary maximum in the polar stratosphere north of the limits of Star Dust sampling) could not be produced by simple diffusion processes. It appeared, further, that the clouds of Soviet debris rose to higher altitudes as they mixed southward, a phenomenon complementary to the sinking of poleward-moving debris observed during HASP. The distribution of Be^{7} within the stratosphere sampled by Star Dust during late-1961 was quite similar to the distribution of that nuclide observed during HASP in late 1959 and early 1960. The stratospheric distribution of Pb^{210} and Po^{210} during late 1961 is difficult to explain because these nuclides were virtually in radioactive equilibrium, suggesting a stratospheric residence time of Pb^{210} in excess of one year. (auth)

23408 (DXRL-F3) FALLOUT IN NEW ZEALAND–FOURTH QUARTER 1961. (New Zealand. Dominion X-Ray and Radium Lab., Christchurch). 16p.

Results of measurements for Sr^{90} in rain and milk to the end of 1961 are presented. Graphs showing the accumulation in soil, the levels in milk, and comparisons with the Northern Hemisphere are included. Fission product beta activity in air filter samples and rain at Christchurch are given. (M.C.G.)

23409 (HW-73366) EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD, JANUARY–MARCH 1962. I. C. Nelson, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 23, 1962. Contract AT(45-1)-1350. 30p.

An evaluation of radiological conditions in the vicinity of Hanford for the first quarter of 1962 indicated some reduction in calculated environmental exposures as compared with the same period of 1961. Natural background with some contribution from world-wide fallout is the primary source of environmental radiation exposure for most persons in the neighborhood of the Hanford controlled area. The principal Hanford source of exposure continues to be identified with radionuclides in reactor cooling water discharged to the Columbia River. For an individual who might regularly drink Pasco sanitary water, ingest local fish and waterfowl, and consume produce from local farms, an intake of boneseeking radionuclides is estimated at about 30% of that recommended by the National Committee on Radiation Protection and Measurements (NCRP) as maximum for continuous intake by persons in the neighborhood of controlled areas. This is ¾ of the amount estimated one year ago for that exposure. The dose to the GI tract from drinking Pasco sanitary water for the 12 months ending with March of 1962 is calculated at 50 mrems, which amounts to about 3% of the recommended maximum permissible limit and is about three-fourths that estimated for a like period one year ago. Fallout from USSR nuclear testing was slight during the quarter. (auth)

23410 (ORNL-TM-270) STRONTIUM, STRONTIUM-90, AND CALCIUM ANALYSES OF CLINCH AND TENNESSEE RIVER CLAMS. D. J. Nelson (Oak Ridge National Lab., Tenn.). June 20, 1962. Contract [W-7405-eng-26]. 20p.

Analyses of clam shells for Sr, Sr^{90}, and Ca are reported. The data include 208 Sr, 80 Sr^{90}, and 35 Ca analyses. Information on age of the clam and shell weight are also included because the Sr concentration in some shells is affected by age and growth rate. A detailed description of sample treatment and preparation is also included. (auth)

Radiation Effects on Living Tissues

Refer also to abstracts 24556, 24557, 24558, 24559, and 24560.

23411 (AERE-R-3977) A STUDY OF THE FEASIBILITY IN THE UNITED KINGDOM OF A RADIATION PROCESS FOR THE INHIBITION OF SPROUTING IN STORED POTATOES. F. J. Ley, I. D. Clarke, and W. G. Burton (United Kingdom Atomic Energy Authority. Research Group. Wantage Research Lab., Wantage, Berks, England). May 1962. 24p.

The organization of the potato industry in the United Kingdom was reviewed in conjunction with the present methods of storage and sprout suppression. The costs of alternative methods of sprout suppression were estimated for comparison with the estimated costs of the radiation treatment. Advantages and disadvantages of the radiation treatment and the factors involved in the costing analysis are briefly outlined and discussed. The commercial feasibility of the radiation processing of potatoes was considered for the United Kingdom potato industry. (auth)

23412 (CEA-2132) ACTION DES RAYONNEMENTS X SUR LES PROTEINES PLASMATIQUES. (The Action of X-Rays on Plasma Proteins). R. Rinaldi, J. Llory, and

M. Suscillon (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucleaires, Grenoble). 1962. 19p.

The agglutinative property of human plasma on the erythrocytes was altered by x rays, owing to an increase of the sedimentation rate of red cells. It was also found that doses of about 5×10^5 roentgens completely denature the macromolecule of serum albumin. (auth)

23413 (TID-15962) RELATIVE EFFECTIVENESS OF 14 Mev NEUTRONS AND 200 KVP X-RAYS FOR PRODUCTION OF LETHALITY IN GRASSHOPPER EMBRYOS. A PRELIMINARY STUDY (thesis). Arden E. Bicker (Kansas. Univ., Lawrence). May 1962. 52p.

A test system using the grasshopper embryo with hatching as the criterion for the end-point was proposed to determine the relative effectiveness of 14 Mev neutrons and 200 kvp x rays. Eggs of Chortophaga (14 day) and Encoptolophus (14 day and terminal) were subjected to various doses of both radiations. Values for the medial lethal doses from the data obtained were 650 rads for Chortophaga, 760 rads for Encoptolophus (14 day), and 1800 rads for Encoptolophus (terminal). The shape of the dose-effect curve relative to x-irradiation survival was assumed to be unchanged so that an estimate of the LD_{50} could be made. The value obtained was 370 rads. The RBE of 14 Mev neutrons and 200 kvp x rays on Chortophaga (14 day) embryos was 1.76. It was concluded that Chortophaga and Encoptolophus embryos irradiated in the 14 day development stage with hatching as an end-point constitute valid systems for the measurement of the relative effectiveness of the 14 Mev neutrons and 200 kvp x rays. (P.C.H.)

23414 (TID-15984) EVALUATION OF LD_{50} LEVEL IN DECAPITATED PLANARIA. James V. McConnell, Margaret L. Clay, and Raymond B. Kauffman (Michigan. Univ., Ann Arbor). [1961]. Contract [AT(11-1)-825]. 7p.

Planaria which had their heads surgically removed within 30 minutes following acute whole-body x-irradiation at dosages ranging from 700 to 1200 r tended to survive more readily than irradiated control animals which did not undergo surgery. (auth)

23415 (TID-16080) FINAL ANNUAL PROGRESS REPORT [ON RADIATION EFFECTS ON BLOOD AND BONE MARROW], MAY 17, 1961–MAY 15, 1962. (Athens. Univ. School of Medicine). Contract AT(30-1)-2769. 9p.

Radiation effects on lipid metabolism of blood and bone marrow cells were studied by measuring the incorporation of acetate-1-C^{14} into the lipids of white blood cells and bone marrow cells. Results show that a dose of 1000 r given to whole blood did not inhibit the incorporation of acetate-1-C^{14}. A dose of 2500 r did not seem to inhibit the incorporation when incubated immediately after irradiation, and a dose of 5000 r produced a small inhibition of 5%. On the other hand, the lipid metabolism of the bone marrow cells was highly inhibited by radiation. (P.C.H.)

23416 (TID-16121) EFFECTS OF X-IRRADIATION OF OVARIAN OVA ON THE MORPHOLOGY OF FERTILIZED OVA AND DEVELOPMENT OF EMBRYOS. E. B. Harvey and M. C. Chang (Worcester Foundation for Experimental Biology, Shrewsbury, Mass.). [1962]. Contract AT(30-1)-1943. 23p.

The time relation between onset of estrus and meiotic division stages in the golden hamster was determined. The morphology of meiotic division stages of the ova are briefly described; neither was observably altered by 200 r x irradiation. Females irradiated at 3 hr before onset of estrus, at onset, and at 5 and 8 hr after onset of estrus had a high percentage of cleaved ova with micronuclei in one of the two blastomeres and a high percentage of degenerations of embryos before implantation. However, when irradiated 9 hr before onset of estrus no cleaved ova had micronuclei, and degeneration of embryos was not significantly different from controls. Ovarian ova in meiotic divisions were not more radiosensitive than ova in diplotene of prophase I (3 hr before onset of estrus), but diplotene ova between 81 and 9 hr before onset of estrus were relatively radioresistant. Ten fetuses of 657 observed were abnormal. However, the weights of the fetuses from irradiated females did not differ significantly from the non-irradiated control fetuses. It was concluded that the percentage of gross abnormalities and weights of fetuses were not significantly altered by 200 r x irradiation of ovarian ova. (P.C.H.)

23417 (TID-16122) THE EFFECT OF IRRADIATION ON THE GROWTH AND FUNCTIONING OF TRANSPLANTED OR REGENERATED ADRENOCORTICAL TISSUE IN THE RAT. Progress Report. Leland C. Wyman, I. Alden Macchi, and George P. Fulton (Boston Univ.). June 30, 1962. Contract AT(30-1)-1254. 22p.

The effects of whole-body x irradiation of male albino rats in single and fractionated doses on adrenal corticoid secretion was evaluated by comparing basal in vitro output rates and plasma corticoid values with control rats. Only BT values showed any reasonably consistent pattern and suggest that although both single and fractionated doses may increase adrenocortical secretion in the post irradiation period, the effects of the latter appear to be exerted earlier and are generally more intense that the former at comparable periods. Analyses were made on corticoids produced in vivo and in vitro isolated from plasma, preincubation fluid, and from incubation fluid and glands after incubation in the absence or presence of ACTH. No gross abnormalities were found in corticoids produced in vitro. Studies made on the vascularization of adrenal transplants showed no visible indication of a revascularization process. Discussion is also given on studies made on homotransplants, autotransplants, and mesenteric autotransplants, and the isotopic determination of blood volume in adrenal glands and adrenal transplants. (P.C.H.)

23418 (TID-16219) BIOLOGICAL AND MEDICAL EFFECTS OF RADIATION. Shields Warren (New England Deaconess Hospital. Cancer Research Inst., Boston). [June 18, 1962]. Contract AT(30-1)-901. 6p.

Three general premises, which underlie the present vigorous utilization of radioactivity by the biological sciences, are discussed. Major amounts of radioactivity are damaging to an organism, and the damage is due, in part, to selective inhibition of growth. Minute amounts of radiation are easily detectable physically but negligible in their effect because of the ability of organisms to repair damage done, or the injury may be so slight as to cause no demonstrable effect. Radiation is also a potent mutagenic agent. (P.C.H.)

23419 (UR-609) LATE MANIFESTATIONS OF WHOLE AND PARTIAL BODY IONIZING RADIATION IN THE DOG: A TWO YEAR SUMMARY. W. J. Quinlan, K. Scheer, R. W. Neidlinger, S. M. Michaelson, and J. W. Howland (Rochester, N. Y. Univ. Atomic Energy Project). May 15, 1962. Contract W-7401-eng-49. 10p.

Beagles of known age, bilaterally exposed to 1000 kvp x rays on the whole or upper part of the body, were continually observed for a period of two years after exposure. Among animals exposed to 260 r MAD (LD 15/30) whole-body total WBC returned to 60-70% of pre-exposure levels two months after irradiation and remained at this level over the two year period. In the 280-340 r MAD (LD 40/30-LD 70/30) whole-body group, the total white blood count re-

turned to 70-80% of normal four months after exposure and plateaued at this level up to two years. Body weight in whole-body exposed dogs increased in comparison with the controls. One death occurred 19 months after exposure in the 340 r whole-body group. In upper body exposed animals (1820 r (LD 10/30) or lower), white blood counts returned to 95% of initial during the third post exposure month and ranged between 80-100% during the two year period. Some upper body exposed animals (970-2125 r MAD) developed pulmonary fibrosis associated with cardiovascular damage and arteriosclerotic changes during this period. Subsequent to this, evidence of thyroid insufficiency was found in some of the upper body irradiated animals. Cataracts developed in upper body irradiated dogs within 1 year after exposure. Deaths occurred in the 2125 r (LD 50/30) upper body group 12 and 18 months after exposure. (auth)

23420 (USNRDL-TR-561) EVIDENCE FOR DIRECT STIMULATION OF THE MAMMALIAN NERVOUS SYSTEM WITH IONIZING RADIATION. E. L. Hunt and D. J. Kimeldorf (Naval Radiological Defense Lab., San Francisco). May 7, 1962. 16p.

In a behavioral study designed to detect the most immediate reaction of the intact nervous system to ionizing radiation, rats were exposed while asleep to x rays (250 kvp), and measurements of behavioral arousal and heart rate were made to indicate activation of the central nervous system (CNS). A transitory behavioral arousal was exhibited within 12 seconds at an exposure rate of 0.25 r/second. At a higher dose rate of 1.9 r/second this initial reaction increased in scope and by 30 seconds included sub-cortical activation as well, as indicated by a heart rate response. These reactions depended upon the rate of exposure and not upon the total dose. In blinded animals, exposure at the high intensity evoked both the behavioral arousal and the heart rate response. This indicated that CNS activation cannot be attributed to the direct effect of radiation on the visual receptor system. Although radiation may act as a stimulus to the CNS through other sensory systems it was also suggested that the nervous system itself is directly sensitive to ionizing radiation. (auth)

23421 (AEC-tr-5141) STUDY OF COMPARATIVE RADIOSENSITIVITY OF DIFFERENT PARTS OF BRAIN IN TERMS OF ALTERED FUNCTION. G. Z. Abdullin. Translated from p.397-408 of "Proceedings of the Symposium on the Effects of Ionizing Radiation on the Nervous System, held in Vienna, June 5-9, 1961." (A publication of the International Atomic Energy Agency, Vienna, 1962.) (STI/PUB/46(p.397-408)). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 16281.

23422 (AEC-tr-5190) ROLE OF THE NERVOUS SYSTEM IN CHANGES OF THE "METABOLIC REACTIVITY" OF THE IRRADIATED ORGANISM. L. Novak, A. Vatsek, and M. Pospishil. Translated from p.449-59 of "Proceedings of the Symposium on the Effects of Ionizing Radiation on the Nervous System, held in Vienna, June 5-9, 1961." (A publication of the International Atomic Energy Agency, Vienna, 1962.) (STI/PUB/46(p.449-59)). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 16284.

23423 (AEC-tr-5215) THE INITIAL MECHANISMS OF THE BIOLOGICAL EFFECTS OF IONIZING RADIATION. (O Nachal'nykh Mekhanizmakh Biologicheskogo Deistviya Ioniziruyushchikh Izluchenii). A. M. Kuzin (U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). Translated by Lydia Venters (Argonne National Lab., Ill.) from report A/AC.82/G/L.639. Aug. 28, 1961. 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 2889.

23424 STERILIZATION OF DRUGS IN AMPOULES BY γ-RAYS. L. Krówcyński, M. Zadumiński, and W. Kotulowa. Acta Polon. Pharm., 18: 125-9(1961).

A Co^{60} γ-ray source was used to sterilize cocarboxylase hydrochloride (dried) contaminated by (1) bacteria and spores of C. welchii, (2) C. septicum, and (3) E. coli bacteria. A quantity of energy equivalent to 4×10^5 rep was sufficient to sterilize the preparation and not cause any decomposition. In order to kill the same bacteria in an aqueous suspension, unsporing E. coli required 8×10^5 rep, and sporing C. welchii and C. septicum required 1.6×10^6 rep. (OID)

23425 THE EFFECT OF γ-RAYS ON FOOD MICROORGANISMS. VIII. THE INFLUENCE OF THE ADDITION OF SOME PRESERVATIVES OR ANTIBIOTICS. Wataru Watanabe. Agr. Biol. Chem., 25: 313-18(Apr. 1961).

The possibilities of intensifying the lethal effect of γ radiation with various substances (sodium benzoate, dehydroacetic acid, Z-furan, tetracycline, etc.) on bacteria in nutritious or non-nutritious pure agar media were investigated. The concentration of the additives was one-tenth of the maximum tolerating dose. It was found that in non-nutritious media these substances enhanced the lethal effect, while in nutritious media they were rather protective. (OID)

23426 THE EFFECT OF γ-RAYS ON FOOD MICROORGANISMS. IX. STUDIES ON THE INFLUENCE OF VARIOUS PHYSICAL CONDITIONS ON THE SURVIVAL OF BACTERIA IRRADIATED. Wataru Watanabe. Agr. Biol. Chem., 25: 448-52(June 1961).

The influence of environmental physical conditions during irradiation on the survival of bacteria was investigated. A metallic foil was placed between the radiation source and the medium, and the effect of secondary rays was studied. Results showed that the lethal effect of γ rays was enhanced and that the effect of tin foil was stronger than that of aluminum foil. In both cases, double sheets were slightly more effective. Little or no secondary radiation from the foil went backward. The addition of protective agents or the attachment of the metallic foil to the medium did not influence the ability of E. coli to survive when the samples were irradiated in the frozen state. (OID)

23427 RADIATION RESEARCH AT A TROPICAL CENTER. Howard Boroughs. AIBS (Am. Inst. Biol. Sci.) Bull., 25-6(Dec. 1961).

Interest in nuclear energy resulted in the formation of an Interamerican Nuclear Energy Commission which is composed of representatives from the 21 member nations of the Organization of American States. The Interamerican Institute of Agricultural Sciences is a part of the Organization of American States and for the last 15 years has been concerned with raising the level of agricultural education in Latin America. Its headquarters are in San José, Costa Rica, and the Tropical Center for Research and Graduate Training is in Turrialba, Costa Rica. The Tropical Center is primarily a graduate school, although it offers short courses of several weeks to several months duration, on such subjects as coffee, cacao, pastures, extension, and quarantine procedures. The U. S. Atomic Energy Commission in 1957 signed a contract with the Institute to encourage the use of nuclear energy in solving problems relating to agriculture in Latin America. In 1958 the technical staff was hired, and the installation of the first gamma field in Latin America was completed. The program at present consists of geneticists who make use of a 1300 curie cesium-137 gamma source in a six-acre field, and scientists who

make use of radioactive tracers in studies of soil-plant relationships, or in plant physiology and biochemistry. An entomologist will use radiation to study the possibility of insect eradication in the tropics, or tracers to study insect metabolism. (auth)

23428 THE EFFECT OF A DEUTERON MICROBEAM ON THE MOUSE CRYSTALLINE LENS. Ludwig von Sallmann, Howard J. Curtis, and Patricia Grimes (National Inst. of Neurological Diseases and Blindness, Bethesda, Md.). A.M.A. Arch. Ophthalmol., 67: 163-70(Feb. 1962). (BNL-6081)

The biologic significance of the radiation injury to the lens caused by exposure to a deuteron beam 0.025 mm in diameter which simulates the ionization of a heavy primary cosmic ray particle was studied in the mouse. Doses up to 33,000 rad administered with this beam produced not more than a few point opacities in the posterior lens cortex which were seen with the biomicroscope and corresponded to Wedl's vesicular cells. A small fraction of this dose delivered through a 1 mm aperture resulted in the development of many fine lenticular opacities and later in the formation of posterior cortical cataract. It is concluded that an ionization track as small as that of a heavy primary cosmic ray particle is not expected to cause more than a few point opacities in the lens cortex when the beam passes through the germinative zone or bow area. If a few degenerate cells are formed, it is possible that they will disintegrate without leaving a biomicroscopically visible trace of damage. (auth)

23429 STRUCTURAL, CYTOLOGICAL AND AUTORADIOGRAPHIC (H^3-THYMIDINE) CHANGES IN THE BONE MARROW FOLLOWING TOTAL BODY IRRADIATION. T. M. Fliedner, V. P. Bond, and E. P. Cronkite (Brookhaven National Lab., Upton, N. Y.). Am. J. Pathol., 38: 599-623(May 1961). (BNL-5032)

Structural and cellular morphologic changes in rat bone marrow were correlated during the degenerative and regenerative phases following exposure to 550, 1000, and 1500 r of x radiation. Tritiated thymidine was injected 30 min prior to sacrifice. It was clearly demonstrated that the vascular bed of the marrow is destroyed, maximum damage at 3 days after irradiation, leading to severe marrow hemorrhage long before the platelet count starts to fall. The time of onset of the early nonthrombopenic marrow hemorrhage is dose dependent and was evident as early as 1 hr after 1500 r. The cellularity in the marrow decreased as the extravasation of red cells increased. After 1000 r, abortive myelocytic regeneration was observed on day 5 and 6, whereas final recovery was found to start after 7 to 8 days with a generalized proliferative stimulation of the marrow reticulum. After 550 r, the degenerative and regenerative phases overlapped and were difficult to separate. After 1500 r, all animals died on day 3. (P.C.H.)

23430 EFFECT OF WHOLE-BODY X RADIATION ON PLASMA IRON DISAPPEARANCE IN THE RAT. L. H. Blackwell, W. K. Sinclair, and R. M. Humphrey (Univ. of Texas, Houston and Texas Medical Center, Houston). Am. J. Physiol., 203: 87-90(July 1962).

Studies on the plasma disappearance half-time of Fe^{59} in whole-body and liver- and spleen-shielded rats given 50 to 800 rad of 200-kvp x rays showed that the half-time became successively longer with doses up to 600 rad (at a level 2.7 times control value). After 600 rad, plasma disappearance half-time began to fall again, but at this level substantial changes also occurred in plasma iron concentration. The time to reach the maximum increase in plasma disappearance half-time continued to rise and was linear with dose up to 700 rad. The changes in plasma iron disappearance half-time have been shown to be directly related to iron uptake changes but the time for the maximum effect in plasma disappearance precedes that for uptake consistently by 0.5 days. Therefore, plasma iron disappearance half-time is a useful practical parameter of radiation injury in the rat up to about the LD_{50}. (auth)

23431 EVOLUTION OF THE THYROID FUNCTION AFTER TRANSCUTANEOUS IRRADIATION IN THE RAT. M. Tubiana, J. George, and J. Doroszewski (Institut Gustave-Roussy, Villejuif (Seine), France). Ann. radiol., 5: 45-54(1962). (In French)

A transcutaneous irradiation of 220 rat thyroids with x-ray doses of 2000 rads causes an early elevation of the curve of intrathyroid fixation of I^{131}, then in the months that followed a lowering of this fixation as well as a decrease in the weight of the thyroid and of its stable I_2 content. The decrease in the fixation is more pronounced in animals with a thyroidectomy. The effects of transcutaneous irradiation were compared with those obtained previously with I^{131}. (tr-auth)

23432 SOME RADIATION PROBLEMS OF SPACE CONQUEST. Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). Astronautik, 4: 272-94(1961). (In English)

Biological and medical aspects of radiation problems in relation to man's conquest of space are discussed. The radiation sources considered are: heavy primary cosmic rays, geomagnetically trapped corpuscular radiations surrounding the earth and other astronomical bodies, solar flare radiations, and radiations inherent in nuclear propulsion systems and nuclear auxiliary power supplier. (P.C.H.)

23433 THE EFFECT OF IONIZING RADIATION ON ALBUMIN. R. Braams. Atoomenergie, 4e: 47-59(Mar. 1962). (In Dutch)

After a survey of the characteristics and structure of albumin and its occurrence in nature, a review is given of the role which albumin has played in the development of radiobiochemistry. The theory of the indirect and the direct effects are reviewed in particular. Because radiobiochemistry generally uses globular albumin as a study material, the fibrillar albumin was treated separately. The chemical modifications observed in irradiated albumin were then discussed. Modern physical methods, such as electron spin resonance, used in radiobiological studies are reviewed. (tr-auth)

23434 STUDIES ON LYMPHOCYTES. I. LYMPHOPENIA PRODUCED BY PROLONGED EXTRACORPOREAL IRRADIATION OF CIRCULATING BLOOD. Eugene P. Cronkite, Cornelius R. Jansen, George C. Mather, Niels O. Nielsen, Edward A. Usenik, Emil R. Adamik, and Clyde R. Sipe (Brookhaven National Lab., Upton, N. Y.). Blood, 20: 203-13(Aug. 1962). (BNL-6011)

A method for extracorporeal irradiation of the circulating blood is described. Extracorporeal irradiation of the blood will produce a lymphopenia promptly which persists for weeks. Heparin in high doses in the calf produces a lymphocytosis and neutrophilic leukocytosis. (auth)

23435 THE USE OF RADIOACTIVE ANTIGLOBULIN FOR THE DETECTION OF ERYTHROCYTE SENSITIZATION. Nicolas Costea, Robert Schwartz, Matthew Constantoulakis, and William Dameshek (New England Center Hospital, Boston and Tufts Univ., Boston). Blood, 20: 214-32(Aug. 1962).

Red cell sensitization by either agglutinating or incomplete antibodies was detected with an I^{131} labeled rabbit antihuman globulin serum (RAG). Non-specific absorption of RAG by red cells was reduced to a minimum by the addition of 6% bovine albumin. The reactions between RAG and the sensitized erythrocytes were typical of antigen-antibody reactions and the sensitivity of the test was found to be greater than the standard Coombs test. Quantitative studies of the degree of erythrocyte sensitization by isoimmune or autoimmune antibodies were possible with this technic. (auth)

23436 RELATIONSHIP OF THE LOCALIZATION OF THE RADIATION AFFECTION TO THE FUNCTIONAL STATE OF THE ORGAN. REPORT III. MORPHOLOGICAL CHANGES OF THE UTERUS IN MICE IRRADIATED AT DIFFERENT STAGES OF THE OESTROGENIC CYCLE. N. V. Sokolova and T. I. Gorshenina. Byull. Eksptl. Biol. i Med., 3: 112-16(Mar. 1962). (In Russian)

The morphology of radiation injuries was studied in relationship to the functional state of the organ during the estrogenic cycle. The uterus of irradiated animals was taken as an experimental model. Oestrus period was regarded as the state of strenuous activity of the organ. Irradiation during the oestrus reduced the life-span of the animals, and also provoking severe necrobiotic changes in the uterus. The life-span of mice irradiated at the phase of rest is prolonged, whereas the morphological changes in the uterus are limited to destruction of individual cells of the covering and glandular epithelium and serous impregnation of the vascular walls. A conclusion was drawn that localization of the radiation injury is largely determined by the extent of the functional state of the organs at the time of irradiation. Marked funtional strain of the organ during irradiation provokes morphological changes mainly in the given system of the body. (auth)

23437 ON THE ELECTRIC REACTION OF THE RETINA IN THE ACTION OF Co^{60} GAMMA-RAYS. R. I. Pogosyan, N. M. Trunova, and A. B. Tsypin. Byull. Eksptl. Biol. i Med., 52: 50-3(Dec. 1961). (In Russian)

Electric reaction of the retina was noted as a result of the Co^{60} gamma-ray action upon the isolated frog eye. This reaction and some of its regularities are very similar to the electroretinogram appearing in light stimulation of the eye. Analysis of personal and literature data has led to a suggestion that photochemical processes are of great significance in the mechanism of radiation phosphene formation. (auth)

23438 ANTIDROMIC VASCULAR AND PUPILLARY REACTIONS IN RABBITS UNDER THE EFFECT OF RADIATION. L. D. Klimovskaya. Byull. Eksptl. Biol. i Med., 53: 22-4(Jan. 1962). (In Russian)

Rabbits were subjected to total-body x irradiation in a dose of 800 to 1000 r. On the 1st to 3rd day a study was made of the reaction of the ciliary tract vessels and of the pupil to stimulation of trigeminal nerve to the discharges of different capacity condensers. There were no significant differences from the control. Comparison of the data obtained with the results of previous investigations concerning the vascular reations in response to the stimulation of the cervical symphathetic nerve leads to a conclusion that the innervation apparatus studied was less sensitive to the action of ionizing radiation than the sympathetic one. (auth)

23439 BIOLOGICAL ACTIVITY OF CATECHOLAMINES IN RABBITS AT VARIOUS INTERVALS AFTER THE IRRADIATION. A. F. Maslova. Byull. Eksptl. Biol. i Med., 53: 25-8(Jan. 1962). (In Russian)

Catecholamines were isolated from the anterior chamber aqueous humor of rabbit eyes at various intervals after irradiation. A study was made of functional disturbances of the isolated frog heart and in pupil diameter in desympathised eyes of frogs following administration of catecholamine. Results indicate that catecholamines are biologically active during the whole period of radiation sickness. (C.H.)

23440 THE INFLUENCE OF DRUGS UPON THE BLOOD SERUM TOXICITY ACQUIRED UNDER THE ACTION OF IONIZING RADIATION. W. W. Alpatov and A. W. Shoobina. Byull. Eksptl. Biol. i Med., 53: 28-31 (Jan. 1962). (In Russian)

The serum of animals treated with ionizing radiation acquires toxicity, which may be detected by using Paramecium caudatum as a test organism. In the present investigation, carried out on dogs, rabbits, and albino rats, four drugs were used (leukogen, caferid, batyl and selarhil alcohols). These drugs rendered the serum of nonirradiated animals more favorable for Paramecia survival and reproduction. The rise of the serum toxicity in the nonirradiated animals is less pronounced with drug administration than without it. (auth)

23441 THE EFFECT OF THE RHYTHM OF STRONTIUM-90 ADMINISTRATION ON THE ACCUMULATION AND KINETICS OF ITS ELIMINATION FROM THE BONES. Yu. I. Moskalev. Byull. Eksptl. Biol. i Med., 53: 59-62 (Jan. 1962). (In Russian)

A study was made of the relationship between the deposition and kinetics of Sr^{90} elimination from the bones of rats after a single, prolonged and fractional injections. As distinct from single introduction, the deposition value and the rate of Sr^{90} elimination from the bones are lower with prolonged and fractional administration of the isotope. Special investigations are necessary to study the regularity of radioisotope accumulation in the critical organ in conditions of their prolonged administration into the organism. (auth)

23442 POST-TRAUMATIC DEGENERATION AND REGENERATION OF SYNAPSES IN THE ACTION OF IONIZING RADIATION. V. P. Babmindra. Byull. Eksptl. Biol. i Med., 53: 112-16(Jan. 1962). (In Russian)

A study was made of degeneration and regeneration of synapses in the upper cervical ganglion and section of the sympathetic trunk on the neck of cats after total single x ray irradiation in a dose of 30, 100, or 500 r. There was an acceleration of these processes after the action of low doses, and delay after the action of high doses. The synapses first restored undergo considerable structural changes with the lapse of time and become small and delicate. The scar at the site of nerve section considerably diminishes in size after the high doses of x-ray irradiation. (auth)

23443 THE EFFECT OF PRELIMINARY RADIOISOTOPE ADMINISTRATION ON THE PERIPHERAL BLOOD COMPOSITION AND THE SURVIVAL OF ANIMALS, SUBSEQUENTLY X-IRRADIATED WITH A LETHAL DOSE. P. I. Lomonos. Byull. Eksptl. Biol. i Med., 53: 79-82(Feb. 1962). (In Russian)

To increase the radioresistance I^{131}, P^{32} and methionine-S^{35} were administered to rats 15, 45, and 55 days prior to the total x irradiation. The survival of rats, to which 20 c of the isotope was previously administrated, increased by 5 to 23% in comparison with controls, depending on the type of the isotope and the interval between the isotope administration and the subsequent x irradiation in a dose of 800 r. The survival of the mice, to which

methionine was administered 15 days prior to the x irradiation in a dose of 600 r, increased by 38%. The number of the peripheral blood leukocytes increased after the administration of radioisotopes to rats. A relatively high leukocyte count in experimental rats was retained after the total x irradiation. As demonstrated, this rise was mainly due to the increased number of neutrophils and eosinophils. (auth)

23444 THE SENSITIVITY OF SKIN CHROMATOPHORES TO THE IONIZING RADIATION. R. I. Pogosyan. Byull. Eksptl. Biol. i Med., 53: 82-4(Feb. 1962). (In Russian)

Radiosensitivity of the skin photoceptors was studied in frogs by means of a photometric method. A preparation of the isolated skin placed in Ringer solution was used as a test object. The light transparency coefficient prior to and after the irradiation was determined. As demonstrated, as distinct from light, irradiation with x and γ rays (Co^{60}) in large doses does not cause statistically authentic changes of the light transparency coefficient of the isolated frog skin. It is suggested that ionizing radiation affects the melanophoric function of amphibia not directly, but through the nervous or endocrine system. (auth)

23445 DISTURBANCE OF THE HEMOPOIETIC SYSTEM REACTIONS AT A LATE PERIOD FOLLOWING THE IRRADIATION. N. I. Shmeleva. Byull. Eksptl. Biol. i Med., 53: 38-42(Apr. 1962). (In Russian)

A study was made of the reactivity of the hemopoietic system of animals at a remote period following the x-ray irradiation. Experiments were conducted on albino rats. Leukocytic reaction was provoked by the administration of Filatov's serum 90, 180, and 270 days following the irradiation at doses of 500 r. Administration of protein stimulus to the animals with radiation sickness 3 months after the irradiation, caused a disturbed reactivity of the blood system. Development of the leukocytic reaction in response to the administration of foreign protein is retarded and prolonged. Disturbed response is evidently connected both with the inhibited maturation of the cells in the bone marrow and their retarded exit to the peripheral blood. (auth)

23446 A CHANGE OF UNCONDITIONED AND CONDITIONED-REFLEX LEUKOCYTIC REACTIONS FOLLOWING X-RAY IRRADIATION. M. I. Ulyanov. Byull. Eksptl. Biol. i Med., 53: 63-8(May 1962). (In Russian)

Experiments were staged on 6 dogs. A study was made of the unconditioned and conditioned-reflex leukocytic reactions, as well as of the background variations of the leukocyte count, prior to and after a single total x-ray irradiation of the animals with the doses of 600, 50, and 3 r. During the first day after the irradiation, an inversion of the leukocytic reactions and of the leukocytic background was noted. During the first minutes after the stimulation leukopenia developed, instead of leukocytosis, as was in the case prior to the irradiation. Variations in the leukocyte count were characterized by a decrease at 600 r and an increase at 50 r and 3 r. With low irradiation doses functional disturbances of the blood system activity could occur in the peripheral blood and bone marrow in the absence of morphological changes. It is quite possible that the functional hematological tests may be of diagnostic significance in radiation affections. (auth)

23447 CYTOCHEMICAL STUDY OF GRANULOCYTE LIPIDS IN THE NORMAL STATE, AFTER IRRADIATION, AND IN LEUKEMIC PATIENTS. D. Raskovic (Université Liegê and Institut Boris Kidsric, Belgrade). Compt. rend. soc. biol., 155: 2455-7(Apr. 1962). (In French)

The lipids are localized in the granulations of the leukocytes of the myeloid line in different ways according to whether neutrophiles and basophiles or eosinophiles are concerned. In the first case they are found throughout the granule, in the second at its periphery. In both cases an essential constituent of these lipids is furnished by phospholipids. These lipids are very resistant to the effect of x rays. On the other hand their concentration in the neutrophiles and basophiles increases in serious ailments of the hematopoietic system such as leukemia, principally basophile and lymphoid leukemia. (tr-auth)

23448 RELATIVE BIOLOGICAL EFFECTIVENESS AND QUALITY OF ELECTROMAGNETIC RADIATIONS IN A TISSUE-EQUIVALENT PHANTOM. Jack Stewart Krohmer (Univ. of Texas, Austin). Dissertation Abstr., 22: 3704(Apr. 1962).

The biological effectiveness of various energies of electromagnetic radiation was determined using human-derived cells (HeLa) in tissue culture as a biological indicator. These measurements were made at various depths within a tissue-equivalent scattering medium (phantom) in order to determine the influence of degradation of the radiation by passage through this scattering medium. With few exceptions, all of the biological effectiveness measurements in the literature have been carried out with little or no energy degradation of the radiation prior to interaction with the biological indicator. A knowledge of the effectiveness or relative biological effectiveness (RBE) of electromagnetic radiations in depth is imperative if one is to predict the effect of given doses of such radiations administered externally to large living organisms such as man. As is true of all measurements of biological effectiveness of radiation, a true quantitation of the administered dose is necessary since this is the parameter in terms of which the effectiveness is expressed. It is most logical to assume that the effectiveness is closely related to energy transfer per unit mass of material; thus absorbed doses were measured and calculated in rads (1 rad = 100 ergs/gram). The calculation of absorbed doses in rads from ionization measurements made with gas-filled detectors requires a knowledge of both the energy characteristics of the radiation at the point of interest and the composition of the medium in which the biological material is exposed. In order to facilitate the calculation, measurements of radiation quality in terms of effective energy were made. These measurements were made with a dual ionization chamber similar to that described by Clarkson and Mayneord (Brit. J. Radiol., 12: 168, 1939) and Greening and Wilson (Brit. J. Radiol., 24: 605, 1951). Methods of calibration and results are included and are compared with quality measurements and calculations reported by other investigators. In addition to the absorbed doses calculated from ionization measurements, similar doses were measured using a chemical dosimeter. These values were found to agree with the calculated values to within about three percent. The electromagnetic radiations which were evaluated were as follows: 1. Gamma radiation from a cobalt-60 teletherapy unit. 2. 250 Kvcp x rays with a Thoraeus III filter. 3. 200 Kvcp x rays with ½ mm Cu + 1 mm Al filter. 4. 220 Kvp x rays with ¼ mm Cu + 1 mm Al filter. 5. 100 Kvp x rays with ¼ mm Cu + 1 mm Al equivalent filter. All irradiations were carried out for several dose levels at depths of 2, 5, 8, and 10 cm below the beam entrance surface of the phantom. The phantom is a water-filled, lucite tank, and the cells were irradiated in plastic, nonwettable test tubes in a growth medium of precisely known composition. Non-irradiated controls were maintained, and "survival" was determined in terms of the survival of the controls. Mean lethal doses and associated

standard deviations were determined with the aid of an IBM 704 computer. The results of the biological studies are as follows: 1. There is no change in the biological effectiveness of any of the electromagnetic radiations with depth in scattering material. 2. There is no difference in the biological effectiveness of any of the x-ray beams at any depth. 3. The RBE of the cobalt-60 gamma-radiation with respect to any of the x rays was found to be 0.90 ± 0.10 regardless of depth. An appraisal of the tissue culture material as a biological radiation indicator is included.

23449 THE EFFECT OF 2,4 DINITROPHENOL ON SURVIVAL, MUTATION AND PHOTOREACTIVATION OF ULTRAVIOLET IRRADIATED E. COLI B/r. Lewis Lawrence Jacobs (Columbia Univ., New York). Dissertation Abstr., 22: 3785-6(Apr. 1962).

After cultures of Escherichia coli, strain B/r, have been exposed to ultraviolet light, higher proportions of survivors and induced mutants are obtained by including dinitrophenol in the plating medium. The extent of recovery depended upon culture medium before and after irradiation. It was possible to obtain 100 percent survival at low radiation doses for cells grown and subsequently plated in minimal media. Dinitrophenol decreased recovery after photoreactivation, but increased reversal of mutation by the light. The dinitrophenol effect was utilized in estimating the length of the middle or latent period for lethality and mutation. The first half of the first post-irradiation division was seen to be the period during which dinitrophenol could reverse lethality. If the first division was prolonged, so was the period during which dinitrophenol could reverse lethality. The induced mutant frequency was observed to fall at a time when the population as a whole was commencing to divide. Dinitrophenol in the incubation medium delayed the fall. Dinitrophenol in the plating medium prevented it. What appears to be interference with both genetic and physiological mechanisms by dinitrophenol is more likely an interference with a mechanism of lethality which exists in several degrees of sensitivity, depending upon whether the cell is a potential mutant or a non-mutant.

23450 POSTIRRADIATION CHANGES IN MICROSOMAL LIPOPROTEIN. M. Šilha (Institute of Biophysics, Czechoslovak Academy of Sciences, Brno). Folio Biol. (Prague), 8: 128-30(1962). (In English)

Rat liver microsomes were isolated. Twenty-four hours after irradiation with a total dose of 800 r, a significant decrease was found by a modification of Dallam's method in the phosphorus content of the microsomal lipoprotein fraction. This decrease is believed to be evidence that, after irradiation, changes occur in the composition, solubility, or other properties of the structural lipoprotein elements. (P.C.H.)

23451 FACTORS THAT GOVERN THE RESPONSE OF PLANT TISSUES TO IONIZING RADIATION. Robert A. Nilan (Washington State Univ., Pullman). Genet. agrar., 12: 283-96(1960). (In English)

Investigations in which various secondary factors were used to modify the effectiveness of irradiation on higher plants are considered. Emphasis is placed on the alteration of the induced mutation process in barley. Methods of controlling the oxygen content and governing the moisture contents of seeds are described. By proper manipulation of seed environment, especially through certain temperature treatments, it appears that the ratio of induced mutations to aberrations can be increased, thus providing greater efficiency in the production of genetic variability for crop improvement. Discussion is also given on after effects in x- or gamma-irradiated seeds. (P.C.H.)

23452 POSTIRRADIATIVE EFFECTS OF NITROGEN AND CARBON MONOXIDE ON HATCHABILITY OF HABROBRACON EGGS TREATED IN FIRST MEIOTIC METAPHASE. Leo E. LaChance (Brookhaven National Lab., Upton, N. Y.). Intern. J. Radiation Biol., 4: 15-20(Oct. 1961). (BNL-4981)

The effects of nitrogen and carbon monoxide as postirradiation treatments were investigated. The hatchability of Habrobracon eggs treated in the first meiotic metaphase was taken as the criterion of damage. Both gases were equally effective in enhancing the damage induced by the radiation. Since restitution is thought to be rare in irradiated metaphase oocytes, the action of the gases is considered as altering a repair mechanism which results in allowing potential damage to become actual. (P.C.H.)

23453 RENAL CHANGES IN THE LAF_1 MOUSE AFTER DAILY EXPOSURE TO COBALT^{60} GAMMA RAYS, WITH PARTICULAR EMPHASIS ON INTERCAPILLARY GLOMERULOSCLEROSIS. Paul H. Guttman, Henry I. Kohn, and Samuel Lesher (Univ. of California, San Francisco and Argonne National Lab., Ill.). Intern. J. Radiation Biol., 4: 49-59(1961).

Beginning at 100 days of age, LAF_1 mice were subjected to 12 and 24 r per day of Co^{60} gamma rays. The exposure occurred during a 12-hour period each day. In the control animals, intercapillary glomerulosclerosis was relatively constant from 100 to 500 days of age, after which it progressively increased. The animals receiving 24 r per day did not survive beyond 500 days of age and did not show significant changes in the kidney. However, the animals receiving 12 r per day survived to 700 days of age. These showed a small but consistently higher degree of intercapillary glomerulosclerosis than the controls after 300 days of age. Small arteries and arterioles of the kidney were not altered. The effect of large doses of gamma rays (up to 7800 r) on the kidneys of LAF_1 mice, given in small daily increments, was less marked than that observed previously after a single, whole-body exposure to 550 r (x rays) of CAF_1 and MALE/c mice. (auth)

23454 NATURAL AND RADIATION-INDUCED RECOMBINATION IN TRITICUM-AGROPYRON OCTOPLOIDS. S. A. Qureshi, F. C. Elliott, R. A. Nilan, and C. F. Konzak (Washington Agricultural Experiment Station, Pullman). J. Heredity, 52: 113-17(May-June 1961).

Cytogenetic studies were conducted on the first and second generations of irradiated and non-irradiated seeds from Triticum-Agropyron crosses. The percent survival of M_1 plants of all crosses was lower in the x-ray treatment than in the thermal neutron treatment. Among the hybrid combinations studied, (A. tricophorum × T. durum)^2 crossed to both SH 191 and SH 198 produced plants of highest fertility. Meiotic analyses of irradiated and control M_1 populations revealed the highest frequency of multivalents in the neutron treatments. Among the spring-type segregates, at the octoploid level in M_2, the greatest number of wheat-like plants was found in the neutron treatment. Control plants with a maximum of only $2n = 52$ chromosomes were found. Meiotic analyses of M_2 plants revealed that those in the neutron treatment carried the highest number of multivalents. Using the increase in number of multivalents in irradiated M_1 and M_2 meioses over those of the control as a criterion of induced translocation and survival of plants from irradiated seeds, the thermal neutron treatment was the more efficient in this experiment. (auth)

23455 EXPERIMENTS ON THE INACTIVATION OF MILK MICROBES WITH COBALT RADIATION. Michel Worseck. Milchwissenschaft, 16: 78-81(Feb. 1961).

Milk samples were irradiated with a sealed Co preparation of 456 r/min such as is used for therapeutical purposes. The experiments were carried out at 5 and 25°C, and the duration of the irradiation was 15, 30, 60, 90, and 120 min. To check the effectiveness of the irradiation, two groups of bacteria were selected which are of great importance in milk hygiene: coliform germs and caseolytes. From the observed bacteria counts, the regression coefficient was determined statistically for the reduction of the total number of bacteria, the caseolytes, and the coliforms and found to be 98.56, 100, and 100%, respectively, at 5°C and 2 hr irradiation corresponding to 53.8×10^3 rep. At 25°C, the same dose worked so slowly that the bacteria multiplied faster during the irradiation period. (OID)

23456 SPECIFIC RADIOPROTECTIVE EFFECT OF THE MITOCHONDRIAL MATRIX. S. J. Adelstein (Harvard Medical School, Boston). Nature, 195: 195-6(July 14, 1962).

Results of experiments on radiation effects on glutamic dehydrogenase without and within the intact mitochondrion are reported. When the intact mitochondrial suspensions were irradiated, no change in the total glutamic dehydrogenase activity could be found with doses up to 133,000 r and no significant activity was found in the supernatants from centrifuged irradiated and nonirradiated mitochondria. A purified, crystalline preparation of beef liver glutamic dehydrogenase was added to a suspension of intact mitochondria and the mixture irradiated. The activity of the free added enzyme was markedly diminished while that of the mitochondrial enzyme was unchanged. However, the presence of the mitochondria did afford some protection to the added enzyme. The results demonstrate that glutamic dehydrogenase contained within the mitochondrial matrix is remarkably well protected from the destructive effects of ionizing radiation. (P.C.H.)

23457 THE EFFECTS OF SOME POSTIRRADIATION TREATMENTS ON THE SURVIVAL OF BACTERIA IRRADIATED WITH Co^{60} γ-RAYS. I. THE RESPONSE OF IRRADIATED BACTERIA TO NUTRITIONAL SUBSTANCES ADDED TO THE POSTIRRADIATION CULTURE MEDIUM. Hajime Kadota, Hideo Miyoshi, and Hiromu Shibata. Nippon Suisan Gakkaishi, 24: 1001-7(Apr. 1959).

A fixed quantity of several of the food microorganisms and Escherichia coli were irradiated by means of cylindrically arranged 39 pieces of pencilled-shaped Co^{60} sources (2100 c) from 30 to 720 kr. The post-irradiation effects on the surviving bacteria are described. The results with respect to dose and pH varied with the different species. However, the effects generally decreased with an increase in the variety of nutritional substance required for bacteria. (OID)

23458 CONSIDERATIONS OF SURVIVAL CURVES AND TARGET THEORY. E. L. Powers (Argonne National Lab., Ill.). Phys. in Med. Biol., 7: 3-27(July 1962).

Results are reviewed from a series of studies on the radiation biology of bacteria. Spores of Bacillus megaterium were grown under controlled conditions and the effects of radiation on survival were observed. Results are discussed. It is pointed out that the target theory as an aid in radiobiology is not so much the understanding of radiation damage as it is the understanding of the biological organism. (C.H.)

23459 ATTENUATION FACTORS FOR CERTAIN TISSUES WHEN THE BODY IS EXPOSED TO NEARLY OMNI-DIRECTIONAL GAMMA RADIATION. F. W. Spiers and T. R. Overton (University of Leeds, Eng.). Phys. in Med. Biol., 7: 35-43(July 1962).

The shielding of certain tissues when the body is exposed to nearly omni-directional γ-radiation has been investigated by measurements in a model, using γ-rays from the nuclides I^{131}, Ra^{226}, and Na^{24}. The attenuation factors for the testes and ovary are shown to be in accord with previous measurements with natural γ-radiation and with theoretical calculations by other workers. It has been possible to deduce the mean attenuation factor for the total active bone marrow over the photon energy range 0.2 to 2.0 Mev. (auth)

23460 THE VARIATION OF NEUTRON DOSE WITH DEPTH IN A TISSUE-EQUIVALENT PHANTOM. J. W. Smith and S. J. Boot (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. in Med. Biol., 7: 45-67(July 1962). (AERE-R-3696)

The fast and slow neutron fluxes through a tissue-equivalent phantom have been measured for several incident neutron energies. The derivation of the components of dose to tissue, from $H^1(n,\gamma)D^2$ and $N^{14}(n,p)C^{14}$ reactions and proton recoils, based on these measurements, is given in detail. The work was directed towards experimental confirmation of the calculated values of Snyder and Neufeld and Kogan et al., for doses to a 30 cm slab phantom irradiated by monoenergetic neutrons. Fair agreement is shown with Snyder and Neufeld, but it is suggested that the gamma dose from $H^1(n,\gamma)D^2$ reactions is overestimated by the use of such a phantom. The results for $N^{14}(n,p)C^{14}$ doses are not in agreement with the calculated values of Kogan et al. It is suggested that the surface recoil proton doses obtained by them are incorrect, as they are considerably lower than the first collision recoil proton doses to tissue for neutrons of the energies considered. Experimental work was extended from the 30-cm slab phantom to a 20 cm thick elliptical phantom irradiated by monoenergetic and complex neutron spectra. (auth)

23461 IONIZING RADIATIONS AND HEREDITY. B. L. Astaurov. Priroda, No. 4, 55-67(Apr. 1962). (In Russian)

The genetic concept of radiation injuries is analyzed. It is shown that radiation injuries induce changes of nuclear nucleoproteids identical to the radiation mutation effects. (R.V.J.)

23462 BACTERICIDAL ACTIVITY OF PHAGOCYTIN FROM RABBITS EXPOSED TO WHOLE BODY X-RADIATION. Mary D. Novak, Milan Novak, and Carolyn W. Hammond (Univ. of Illinois, Chicago). Proc. Soc. Exptl. Biol. Med., 110: 223-5(June 1962).

Peritoneal exudates were induced in female rabbits and collected either 1, 5, or 30 days after total-body exposure to 400 r and 1 or 5 days after 500 r. Exudate cells from unirradiated rabbits served as controls. Phagocytin was extracted from the exudate cells (heterophils) and tested for bactericidal activity against Escherichia coli, Salmonella enteritidis, Klebsiella pneumoniae, and Pseudomonas aeruginosa. Phagocytin from cells collected 1 day after exposure to 400 or 500 r and 5 days after exposure to 500 r showed a decreased activity against all the test microorganisms. Phagocytin from cells collected 5 days after exposure to 400 r showed only a slight change in activity from controls. A marked increase in phagocytin activity was observed in extracts of cells collected 30 days after exposure to 400 r. (auth)

23463 CREATINE SYNTHESIS IN THE PERFUSED LIVER OF NORMAL AND X-IRRADIATED RATS. G. B. Gerber, G. Gerber, T. R. Koszalka, and L. L. Miller (Univ. of Rochester, N. Y.). Proc. Soc. Exptl. Biol. Med., 110: 338-9(June 1962).

The synthesis of creatine from glycocyamine was studied in the perfused liver of normal and whole body x-irradiated

rats. No significant difference was found in the ability of the perfused liver to synthesize creatine when normal and x-irradiated rats were compared. It is postulated that radiation-induced creatinuria does not result from an increased synthesis of creatine by the liver, but rather from a decreased utilization of creatine by skeletal muscle. (auth)

23464 STRONTIUM-90 INDUCED OSTEOSARCOMAS STUDIED BY SERIAL ROENTGENOGRAPHY. Miriam P. Finkel, Birute O. Biskis, and Patricia J. Bergstrand (Argonne National Lab., Ill.). Radiology, 77: 269-8(Aug. 1961). (UAC-4763)

Mice, CF1 and CBA, were injected with a potent carcinogenic amount of Sr^{90}, after which they were examined roentgenographically at weekly intervals for the appearance and growth of osteosarcomas. The osteosarcomas were distributed at random among the mice, the average number per mouse being 4.3 among the CF1's and 4.0 among the CBA's. Tumor incidence recorded at the time of x-ray diagnosis was similar to the incidence recorded at the time of death except that it preceded the latter by about 30 days. The morbidity-mortality rate increased until the populations were very small whereas the true morbidity rate decreased rather sharply while many animals were still alive. Tumor data for the two strains were very similar, with few exceptions. The average rate of growth of all the tumors for 10 weeks, starting with the week of first positive x-ray diagnosis, followed the power function, $t^{2.57}$. However, three phases of growth were indicated. Up to 3 and after 7 weeks growth was somewhat slower. From 3 to 7 weeks tumor volume increased as the 3.2 power of time. The total mass of neoplastic tissue increased more rapidly in the CF1 population than in the CBA. It is suggested that the CBA host might provide a less favorable environment for the early establishment of an osteosarcoma than the CF1 host. (P.C.H.)

23465 RADIATION BREAKAGE OF HUMAN CHROMOSOMES IN VIVO AND IN VITRO. Amos Norman, Richard E. Ottoman, and Robert C. Veomett (Univ. of California, Los Angeles). Radiology, 79: 115-17(July 1962).

Preliminary data are given on the immediate effect of radiation on leukocytes irradiated in vivo and in vitro. The data permit an estimate of the radiosensitivity of human chromosomes. (T.R.H.)

23466 "OXYGEN EFFECT FACTOR" OF HUMAN SKIN. Herman D. Suit (Univ. of Texas, Houston). Radiology, 79: 118-19(July 1962).

The anterior surface of the forearm of one patient and the thigh of a second patient were used as test sites for observing radiation reaction of skin. In the normal skin three 1.5-cm. circular fields received 2,000, 2,500, and 3,000 rads (60 kv, 2 cm. TSD). With an orthopedic tourniquet applied above the test areas, a parallel set of three fields were treated with 4,000, 5,000, and 6,000 rads. The skin reactions in the areas treated under normal conditions were a little more severe than in those treated while a tourniquet was in place. These results give an oxygen effect factor of ≥ 2 for 60 kv. (auth)

23467 FERTILITY OF FEMALE MICE IRRADIATED WITH FISSION NEUTRONS. Howard H. Vogel and Donn L. Jordan (Argonne National Lab., Ill.). Radiology, 79: 120-5 (July 1962).

Young adult female CF No. 1 mice were given single whole-body irradiations with fission neutrons at doses of 20, 50, 75, 100, and 150 rads, at 5 rads per minute, and were subsequently mated with unirradiated male mice in a series of six consecutive tests over a thirteen-month period after exposure. The relation of neutron dose and lifetime progeny was found to follow closely an exponential pattern in this mouse. Animals that had received 75 rads or more became completely sterile within one or two matings. However, even after 150 rads, the highest dose used, some mice produced a few viable offspring, at least for the first breeding test at one week after irradiation. A single irradiation of 50 rads caused a significant and progressive decrease in the percentage of pregnancies and in average litter size. Twenty rads produced no significant effects during the first three tests, but both percentage of pregnancies and average litter size were reduced by the fifth or sixth test. It can be predicted that a dose of 20 to 40 rads of neutrons will decrease by 50% the number of litters born, expressed as percentage of controls. A single dose of 80 to 90 rads of fission neutrons will produce complete and permanent sterility in this mouse within several weeks after exposure. There did not seem to be a significant increase in the mortality of the young in any of the irradiated groups during the period between birth and weaning over that found in the controls. (auth)

23468 RADIATION CONDITIONED EARLY CHANGES OF CELL NUCLEI PROTEINS. II. COMPARATIVE INVESTIGATION OF THE CONCENTRATIONS OF NUCLEAR GLOBULIN AND HISTONE IN LYMPHATIC AND PARENCHYMATOUS TISSUES. Hanna Ernst (Heiligenberg-Instituts, Ger.). Z. Naturforsch. 17b: 300-5(May 1962). (In German)

From sucrose-isolated liver cells of whole-body irradiated rats, the nuclear globulin-albumin and histone fractions were extracted and their nitric and nuclei acid contents analyzed. Also in the liver, as previously in the spleen and thymus a nucleoprotein decrease in both fractions immediately after the irradiation was determined. The in vivo radioinduced damage to the DNA-histone complex led, in the liver, to temporary decomposition of large amounts of histone without that resulting from concentration changes in DNA. From the analyzed quantities, organ weight, cell count, DNA-content, and nucleoprotein nitrogen, the radioinduced changes in the tissues, whose damage picture is well-known histologically can be detected chemically, and, for the time span investigated, can be divided into two periods: an early change, and separated by a short recovery phase, extensive but slow nucleoprotein decomposition is reversible only in the parenchymatous cell nuclei. In the lymphatic nuclei the simultaneous damage of nucleoprotein and DNA leads to ruin of the nuclei. In the radioinduced damage to histone in spleen and thymus, early sections of the reaction chain which leads to the destruction of the DNA-nucleoprotein complexes in irradiated lymphocytes were observed. (tr-auth)

23469 INCREASING THE EFFICIENCY OF MUTATION INDUCTION. R. A. Nilan and C. F. Konzak (Washington State Univ., Pullman). p.437-60 of "Mutation and Plant Breeding." NAS-NRC 891. 1961.

The study and use of induced mutations for the improvement of agricultural crops are discussed. Data are presented from studies of the control and manipulation of secondary factors that influence the radiosensitivity of barley seeds. Investigations related to appearance, detection, and selection of induced plant mutations are described. (C.H.)

23470 THE RELATIONSHIP OF RADIATIONS AND ENVIRONMENTAL CHANGES IN OXYGEN CONCENTRATIONS FOR BIOLOGICAL DAMAGE IN THE IMMATURE GERM CELLS OF DROSOPHILA VIRILIS. Mary L.

Alexander (Univ. of Texas, Houston). p.3-4 of "Proceedings of the International Congress of Genetics, 10th [held at] McGill University, Montreal, August 20-27, 1958." Vol. II. Toronto, University of Toronto Press, 1958.

Lethal damage in meiotic and spermatogonial cells was found to be influenced by increased oxygen concentrations with both x ray and fast neutrons. Differences in lethal damage induced in spermatids by gamma rays in pure oxygen were obtained by varying radiation dose rates. Biological damage induced by x and gamma rays and fast neutrons was consistently higher in spermatids than in mature sperm when oxygen was present at the time of treatment. A slight but definite enhancement was also obtained with oxygen with fast neutrons in various types of immature germ cells. (P.C.H.)

23471 RESPONSE OF THE NERVOUS SYSTEM TO IONIZING RADIATION. Proceedings of an International Symposium held at Northwestern University Medical School, Chicago, Illinois, September 7-9, 1960. Thomas J. Haley and Ray S. Snider, eds. London, Academic Press, 1962. 797p. 128s. 6d.

A combined meeting of radiobiologists and neurologists was held. Forty-three papers were presented on five major topics: radiation effects on the developing nervous system, histopathological changes in irradiation of the nervous system, particle irradiation of the central nervous system, functional changes in nervous system from radiation exposure, and psychological effects of radiation. Separate abstracts have been prepared for each paper. (T.R.H.)

23472 MAJOR RADIOBIOLOGICAL CONCEPTS AND EFFECTS OF IONIZING RADIATIONS ON THE EMBRYO AND FETUS. Roberts Rugh (Columbia Univ., New York). p.3-26 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The early embryo is more radiosensitive than is the organism at any other time in its entire life cycle. The earlier the stage, the more sensitive, with regard to both survival and the development of anomalies. At the cellular level, there is no such thing as "recovery" from irradiation damage, meaning a return to the preirradiated state. Since embryonic cells are precursors of all cells of the adult, irreparable damage to surviving cells results in such damage to all descendant cells of the adult organism. Ionizing radiations represent a very potent tool. The embryo, in contrast with the adult, has powers of reorganizing its residual and surviving cells so that topographic normality may be achieved. However, every such individual will be deficient, either in parts or in the stunting of the whole. Deficiencies are seldom similar in litter mates, owing to the submicroscopic nature of ionizing radiations, the genetic variations in individuals, the varying abilities for restitution, and probably other factors. Irradiation of the embryo is the only way to produce irradiation congenital anomalies, but such anomalies may be produced by other traumatic means. Following organogenesis, irradiation effects are similar to those one expects in the adult. The embryo after a certain stage possesses gonad primordia or developing gonads, and these are subject to irradiation effects which may not be evident for generations. Central nervous system anomalies may be produced by irradiation of the mature gamete of either sex, the fertilized egg, or any stage in development prior to completion of neurogenesis. Some formative cells are present even after the birth of the mammal. The range of radiosensitivity of gamete to formed organism is such that discussion of threshold is meaningless. We cannot now state the extent or the duration of irradiation damage to the developing central nervous system. There may well be subtle effects to be revealed by population studies over generations. Any exposure of the early embryo should be regarded as too much. (auth)

23473 QUANTITATIVE HISTOLOGIC AND BEHAVIORAL STUDIES ON EFFECTS OF FETAL X-IRRADIATION IN DEVELOPING CEREBRAL CORTEX OF WHITE RAT. K. R. Brizzee, L. A. Jacobs, X. Kharetchko, and J. C. Sharp (Univ. of Utah, Salt Lake City). p.27-40 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Exposure to fractionated doses of total-body x-irradiation at 100, 200, and 300 r (60 r per minute) over a period of 5 to 7 days after the 10th of gestation results in no significant difference in neuron packing density in area 2 in the first 20 days of postnatal life. Neuroglial packing density and the neuroglial/neuron index are higher in the 300 r group in 1-day-old animals than in controls, but at later stages the differences are not significant. Mean values for neuron soma volume in 1-, 5-, and 10-day-old irradiated animals are consistently lower than in nonirradiated series, but are higher at the 20-day stage in irradiated than in the control animals. The differences are considered to be within the range of error of the methods employed. The nucleocytoplasmic ratio decreased steadily from the 1st to the 20th days, and no significant differences occurred between irradiated and control series. Brain weight varied inversely with irradiation dose at the 10- and 20-day stages and in 200 and 300 r groups at the 1- and 5-day stages. Cortical thickness in the 100 r group was not significantly different from controls. In the 200 r and 300 r groups, however, cortical thickness varied inversely with dose level, and significant differences between the 200 and 300 r groups and between the irradiated and control groups occurred at the 20-day stages in all areas. It is concluded that the doses of fetal x-irradiation employed produced no significant differences in volumetric or density relationships or general cytoarchitecture between irradiated and control animals in area 2 but resulted in a significant decrease in total number of cells in this zone. (auth)

23474 STRUCTURAL AND BEHAVIORAL ALTERATION IN THE RAT FOLLOWING CUMULATIVE EXPOSURE OF THE CENTRAL NERVOUS SYSTEM TO X-IRRADIATION. Robert H. Brownson (Medical Coll. of Virginia, Richmond). p.41-57 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Rats were exposed to total head x-irradiation in doses of 1,000 r per week until accumulations by groups of six animals ranged from 1,820 to 5,000 r. During the interval following each exposure to ionizing rays, animals in all dosage levels demonstrated changes in behavior, physical appearance, and weight. Quantitative food reduction had a deleterious effect on the general well-being and survival of the animals receiving the larger accumulated doses of x-irradiation. Neurons in the cerebral cortex, brain stem, and cerebellum demonstrated slight to severe alterations throughout all dose levels. Generally, cell change became more frequent and in some instances more severe with increasing accumulation of total roentgens and time following exposure. Neuroglial elements underwent variable minor alteration. Astrocytes were most frequently observed undergoing hyperplasia and hypertrophy. Meningeal thickening with some evidence of cellular and fibrillary infiltration was observed throughout all dose levels. Endothelial and adventitial changes were noted in small and medium size intramedullary vessels with perivascular accumulations of large nucleated cells. Changes in blood vessels were directly related to increasing dosage and

time. General observation indicated that changes in cells leading to necrosis were similar throughout the various dose levels and days after exposure. The increasing severity in reactions associated with time and dose were more quantiative than qualitative. (auth)

23475 BEHAVIORAL AND HISTOLOGIC EFFECTS OF HEAD IRRADIATION IN NEWBORN RATS. James N. Yamazaki, Leslie R. Bennett, and Carmine D. Clemente (Univ. of California, Los Angeles and Veterans Administration Hospitals, Los Angeles and Sepulveda, Calif.). p.59-73 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Newborn rats ranging in age from 8 hours to 15 days received single doses of x-radiation to the head only. Doses of 125 r, 300 r, 500 r, and 1,000 r were administered. One group of animals was sacrificed at 48 to 72 hours after irradiation, and another group was autopsied at ages ranging from 14 days to 15 months. The study demonstrated the development of a marked radioresistance in the brain by the 3rd postnatal week, compared to the easily damaged brain of the rat during the first postnatal week. The development of this relative radioresistance following the first week of life was abrupt. The radiosensitivity was manifested by an increased mortality, retarded growth, retarded brain size, production of cataracts, and abnormal neurologic signs in the radiated animals. The neuropathologic findings correlated closely with the behavioral disturbances. Prominent among the early microscopic findings was damage to capillaries. Later histopathologic findings included perivasculitis, progressive thickening of the vessel walls and a narrowing of the vessel lumen, meningitis, inflammation of the choroid plexus, ventricular enlargement, delayed cerebral cortical and cerebellar development, focal necrosis, and gliosis. (auth)

23476 CYTOPLASMIC INCLUSIONS CONTAINING DEOXYRIBONUCLEIC ACID IN THE NEUTRAL TUBE OF CHICK EMBRYOS EXPOSED TO IONIZING RADIATION. Mary Elmore Sauer and Donald Duncan (Univ. of Texas, Galveston). p.75-94 of "Response to the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The material consisted of 2- to 4-day chick embryos subjected to 200 to 500 r of x-irradiation or labeled with thymidine-H^3 to high specific activity. Moderate doses of radiation led to a structural change in the cytoplasm in numerous cells of the early neural tube. A striking feature a few hours following exposure to ionizing radiation was the presence within the cytoplasm of one or more dense, basophilic bodies approximately 2-5 μ in diameter. These typically consisted of one or several Feulgen-positive centers, surrounded by an RNA-containing rim. The centers were digested by DNase. They represent a relatively large amount of extranuclear DNA. Electron microscopy demonstrated their great density and confirmed their cytoplasmic location. At the lower dosage of x-ray, the process was completely reversible, without an intervening period of degeneration. The bodies were not confined to the neural tube, although they attained great prominence there, but were widely distributed throughout the embryo. It is concluded that the bodies are of several types. It is possible to distinguish between those resulting from degeneration of mitotic stages and those of interphases on the basis of their morphology. Micronuclei are another type, sometimes present in considerable number. (auth)

23477 BIOCHEMICAL EFFECTS OF IRRADIATION IN THE BRAIN OF THE NEONATAL RAT. O. A. Schjeide, J. N. Yamazaki, C. D. Clemente, Nancy Ragan, and Sue Simons (Univ. of California, Los Angeles and Veterans Administration Hospitals, Los Angeles and Sepulveda, Calif.). p.95-108 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

All three major divisions of the brain (brain stem, cortex, and cerebellum) were inhibited in growth following irradiation (750 r) to the head at 2 days of age. Growth of brain stem was not retarded until about the 16th day, and due to a relatively slow rate of growth in the control animals, the difference in dry weight of this part of the brain at 4 weeks postirradiation was not great. In cortex, the inhibition of growth was also first discernible at about 16 days, but due to a relatively fast rate of increase in the control animals, the differential between control and irradiated cortices at 4 weeks was very significant. Cerebellum was most profoundly affected by x-irradiation, the decrease in size being quite apparent early in the 2nd week following exposure. Although in this preliminary survey no differences could be detected between irradiated and control cortices (and cerebellums) in terms of relative lipid, relative phospholipid, and relative nitrogen, irradiated brain stem appeared to contain relatively less total lipid beginning at about 14 days following exposure. The inhibition of lipid synthesis in the brain stem (failure of myelination) was accompanied by a parallel retardation of the dehydration normally occurring as a function of age. Some tissues from irradiated brain revealed decreases in wet volumes of mitochondria. In no case was there a significant increase of mitochondria in irradiated tissue. The ratio of palmitic acid to stearic acid and to oleic acid in the nuclei decreased as a function of age. The development of this ratio was retarded in the irradiated tissues examined. (auth)

23478 SOME EFFECTS OF NUCLEIC ACID ANTIMETABOLITES ON THE CENTRAL NERVOUS SYSTEM OF THE CAT. Harold Koenig (Veterans Administration Research Hospital and Northwestern Univ., Chicago). p.109-21 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Intrathecal administration of the fluorinated pyrimidines, FO, FUR, and FCR, results in interesting neurologic disorders, the nature of which depends on the injection site. Myelopathy, rhombencephalopathy, and cortical encephalopathy are produced by the intralumbar, intracisternal, and intracerebral routes, respectively. An asymptomatic "incubation" period precedes the appearance of neural dysfunction. Signs of neuronal hyperirritability appear first. In more severe intoxications, loss of neuronal function follows the stage of neuronal irritation. Alterations in neuronal structure accompany the neurologic disorder. RNA-containing structures, i.e., nucleoli and Nissl bodies, are conspicuously affected. The neuronopathy may be reversible or may result in necrobiosis, depending on the severity of intoxication. Spongy degeneration of white matter occurs later, probably caused by oligodendroglial disease. FO undergoes conversion to acid-soluble nucleotides and is incorporated into RNA in the feline neuraxis. Indeed, anabolic conversion of the fluorinated pyrimidines seems to be a requirement for the production of neural dysfunction. A depletion of RNA and a depression in protein biosynthesis appear later and are most marked in neurons that become inexcitable. Disturbances in other metabolic spheres may exist, but have not been demonstrated. Many points of similarity, both physiologic and pathologic, can be discerned between the disorders described and some virus infections and degenerative diseases of the nervous system. It seems possible, therefore,

that derangements in pyrimidine nucleotide or nucleic acid metabolism may be present in some of the latter disorders. The fluorinated pyrimidines are useful tools for the production of focal neuronal disease. Their use may provide experimental models for some of the degenerative neuronal diseases that afflict man. (auth)

23479 GEOGRAPHIC DISTRIBUTION OF MULTIPLE SCLEROSIS IN RELATION TO GEOMAGNETIC LATITUDE AND COSMIC RAYS. John S. Barlow (Massachusetts General Hospital, Boston). p.123-50 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Multiple sclerosis appears to exhibit a fairly well marked geographic distribution, being appreciably more frequent in northern than in southern latitudes in certain areas of the world. It is generally agreed that this geographic distribution must be taken into account in any satisfactory theory of etiology of the disease. Possible correlates of the geographic distribution which previously have been advanced have not appeared entirely satisfactory; certainly geographic latitude itself appears to be a poor correlate. Several independent sets of statistics on the distribution of the disease were examined from the standpoint of geomagnetic latitude, a parameter that is related to the earth's magnetic axis in the same way that geographic latitude is related to the earth's axis of rotation. That the distribution of multiple sclerosis might be examined in this way was suggested by the fact that a variation with geomagnetic latitude is well known for the intensity of cosmic rays. The frequencies of the disease in widely separated areas were found to vary in a systematic manner with geomagnetic latitude; therefore, the possibility arises that cosmic rays in some way might be a factor in the occurrence of the disease. The latitude distribution for the disease bears some resemblance to that for a particular component of the primary cosmic radiation at the top of the atmosphere; no similarly good correlate is apparent, however, among the various cosmic ray components at the surface of the earth, hence the similarity may be entirely fortuitous. Some possible intermediary factors examined appear to offer no great promise. A world map, on which is indicated the expected geographic distribution of multiple sclerosis on the basis of geomagnetic latitude, is presented for comparison with results of future surveys on the disease so that the present results may be evaluated further. (auth)

23480 BASIC PROBLEMS IN THE HISTOPATHOLOGY OF RADIATION OF THE CENTRAL NERVOUS SYSTEM. Orville T. Bailey (Univ. of Illinois, Chicago). p.165-89 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A review of the literature related to the effects of gamma and roentgen radiation of the central nervous system is presented and compared with personal material, with a few comments on the effects of beta radiation. The reaction of the central nervous system hours or a few days after radiation is an acute inflammatory one, dominated by vasculitis, meningitis, and choroid plexitis. Regressive changes, apparently mostly reversible, are present in the granule cells of the cerebellum. Young animals are more susceptible to radiation damage than adults, but histologic effects can be produced at any age with sufficient dosage. Different and more extensive degenerative processes become evident as the time interval between radiation and sacrifice is lengthened. This interval can be reduced by increasing the dose of radiation, increasing the intensity of radiation, and possibly by other factors. In late stage of radiation reaction, there is extensive damage to neurons, with selectivity for the white matter and particular sensitivity of the brain stem and hypothalamus. Degenerative changes in blood vessels, sometimes with complete occlusion, can be demonstrated at this stage. The effects on neurons are considered by most, but not all, workers to be direct effects and not mediated through vascular insufficiency. All types of glia show degenerative changes after radiation, and there is a prolonged inhibition of glial response in repair. Proliferation of collagenous tissue is important in the first stages of repair. Compound granular corpuscle formation is resumed before astrocytic proliferation begins. Some months after radiation, astrocytosis becomes exuberant. Despite many contradictions in results and interpretation, a basic pattern of degeneration and repair in response to gamma and roentgen radiation is becoming apparent by light microscopy. The most striking single feature is the progressive increase in evidence of damage as time after radiation is lengthened. It is impossible to predict end results from any characteristics of the acute response. Investigations by all techniques will be required to explain the processes going on in the interval, and studies of this type may well have biologic implications beyond the field of radiation pathology. (auth)

23481 SEQUENCE OF X-RADIATION DAMAGE IN MOUSE CEREBELLUM. Norbert Schümmelfeder (Universität, Bonn). p.191-210 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Development and course of radiation lesions in the cerebellum in mice were studied after exposure to single doses of x-rays, 250 to 60,000 r, applied to one cerebellar hemisphere through apertures 3 × 3 mm or 0.5 × 2 mm in diameter. Degree and severity of radiation damage in the cerebellum was correlated in terms of time-intensity relationships with the x-ray dose. After a dose of 60,000 r, morphologic changes of different cerebellar structures (e.g., nerve cells of the molecular layer and Purkinje and granule cells) were visible as early as 30 minutes following exposure and were fully developed at 60 minutes. Within 90 hours, complete necrosis of the irradiated cerebellar area with concomitant resorptive and reparative changes was observed. Cystic liquefaction eventually occurred. After less intense x-ray doses, 60,000 to 10,000 r, similar radiation lesions were observed, but the latent period of their inception was longer. Exposure to doses below 10,000 r down to 4,000 r resulted in necrosis of the granular layer and in destruction of single nerve cells in other parts of the cerebellar cortex. The latent time was more prolonged. Radiation damage finally resulted in the formation of a glial scar. At x-ray doses below 4,000 r, only single nerve cells or cell groups were damaged, and the latent period was correspondingly lengthened. In such lesions, proliferation of glial elements and capillaries ultimately occurred, and hyalinosis developed in the walls of distended blood vessels. Since no evidence of vascular alterations was observed before development of nerve cell lesions, the visible radiation damage was interpreted as due to a direct effect of the ionizing radiation on the cellular elements of cerebellar tissue. The acridine orange fluorescence technique was used to determine whether alterations occur in the structural organization of the DNA in pyknotic nuclei of irradiated granule cells and in the RNA content of Purkinje cells. Our results indicated that after irradiation DNA of pyknotic nuclei in the granular layer is not depolymerized to a noticeable degree. These pyknotic nuclei were more resistant than normal to treatment with depolymerizing and hydrolysing chemical agents and DNase. Without further experimentation it is difficult

to say whether this increased resistance of irradiated, pyknotic nuclei is an immediate and specific effect due to the action of ionizing radiation on the DNA or whether it is a nonspecific effect due to increased density of the nuclear mass. Within the region damaged by irradiation, Purkinje cells in a state of regression showed remarkable decrease or loss of cytoplasmic RNA which was obviously secondary to cellular regression. (auth)

23482 MORPHOLOGICAL EFFECT OF REPEATED LOW DOSAGE AND SINGLE HIGH DOSAGE APPLICATION OF X-IRRADIATION TO THE CENTRAL NERVOUS SYSTEM. Willibald Scholz, Wolfgang Schlote, and Wolfgang Hirschberger (Max-Planck-Institut, Munich). p.211-32 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

X-irradiation of the spinal cords of 36 rabbits produced results similar to the previously reported delayed x-ray lesions in the brains of dogs. The fractionated application of doses up to 11,000 r within 40 days and single doses of 2,000 r were followed by focal zones of disintegration, mainly situated in the white matter, but also affecting the gray substance. These changes occurred after latent periods of from 4 to 33 weeks. The fibrinoid disorganization of the vessel walls, erythrodiapedesis, and infiltration of plasmatic material into the central nervous tissue seem to be the primary lesions and demonstrate a breakdown of the hematoencephalic barrier. All other changes of the tissue, including demyelination and breakdown of cellular constituents, were preceded by permeability disturbance and may be considered secondary. In the brains of approximately 100 Syrian hamsters, acute radionecroses were produced by single applications of large x-ray doses of high intensity. In animals receiving 5,000 r, necroses were fully developed within 8 days; within 6 days after 10,000 r, and within 3 days after 45,000 r. Several animals receiving 20,000 r showed distinct disintegration of tissue in the field of irradiation after 24 hours, and initial stages in these cases could be detected after only 7 hours. The sharply limited semicircularly shaped lesions covered exactly the field of irradiation and decreased in depth with the diminution of the x-ray dose and abbreviation of the survival time. In fully developed necroses, all cellular elements were broken down, and erythrodiapedesis from more or less numerous vessels occurred not only within, but also out of the necrotic zone. Initial stages demonstrated a spongy transformation of the nervous tissue with only minor changes of the cellular constituents, such as plasma and nuclear shrinkage. Here, erythrodiapedesis was still lacking. A disorder of the hematoencephalic barrier in this initially spongy territory could not be demonstrated by intravital trypan blue staining, while a blue coloration of a large area including the surrounding region of spongy loosening became visible before a distinct disintegration of tissue, indicated by signs of cell necrosis, were demonstrable. Solitary small diapedetic hemorrhages and the immigration of single leucocytes seem to indicate a degree of permeability disorder sufficient to allow an intravital staining with trypan blue. This behavior and the appearance of more or less small hemorrhages at the borders of, and sometimes far from, the necrotic foci point to the significance of an early disorder of the blood-brain barrier. Since nerve cells have been shown to be rather resistant within zones of edematous loosening of tissue, and astrocytes even may become progressive, the whole process of necrosis cannot be considered as solely secondary to the permeability disorder. From the morphologic facts, it seems justified to admit that in acute radionecrosis from large x-ray doses of high intensity a direct effect on the nervous and astrocytic tissue constituents may occur simultaneously with vascular damage. Processes of transformation, resorption, and organization develop slowly and are established regularly only at the borders of the necrotic zones. (auth)

23483 A DEMYELINATING OR MALACIC MYELOPATHY AND MYODEGENERATION—DELAYED EFFECT OF LOCALIZED X-IRRADIATION IN EXPERIMENTAL RATS AND MONKEYS. J. R. M. Innes and A. Carsten (Brookhaven National Lab., Upton, N. Y.). p.233-47 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A study was made of the demyelinating myelopathy in rats and monkeys with upper body irradiation. All animals received 3500 rads, some with upper body exposure, some thoracic exposure, and others a spinal exposure. After an unpredictable latent period, sometimes many months, a severe myelopathy is produced. White matter is more sensitive than gray. There was no evidence of deposition of degenerative material near vessels. Degeneration and necrosis of vertebral muscles was observed in the irradiated area. (T.R.H.)

23484 EFFECTS OF HIGH-DOSE GAMMA RADIATION ON THE BRAIN AND ON INDIVIDUAL NEURONS. F. Stephen Vogel (Cornell Univ., New York). p.249-60 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Monkeys, mice, dogs, and rabbits were irradiated in doses of 1000 to 30,000 r to head, or body or both, and detailed morphologic studies of the brain were made. The pathologic changes were the same whether the exposure was head or whole-body and were absent for head-shielded exposures. A nucleus diameter reduction in granule cells of dogs and monkeys was observed. Observations were recorded in connection with vasculitis, meningitis, and choroid plexitis. (T.R.H.)

23485 ELECTRON MICROSCOPE OBSERVATIONS ON THE X-IRRADIATED CENTRAL NERVOUS SYSTEM OF THE SYRIAN HAMSTER. H. Hager, W. Hirschberger, and A. Breit (Max-Planck-Institut, Munich). p.261-75 of "Response of Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The early alterations consisting of astrocytic swelling, plasma exudation, and erythrodiapedesis are all to be considered secondary to increased vascular permeability. It would seem that an acute effect of ionizing radiation is to interfere with basic cellular mechanisms of the cell and, while probably affecting all elements of the central nervous system, to have its most dramatic effect on the blood vessels which manifest this functional derangement by increased permeability, thus allowing fluid and erythrocytes to pass. Changes in the granular cells of the cerebellum similar to those following x-irradiation have been described in a number of conditions where there was definite or presumptive evidence of edema. It is, therefore, entirely possible that the striking change of granular cells is not a direct radiation effect, but is a nonspecific reaction of this type of cell to the presence of edema. A study on ultrastructural alterations in the brain following extensive cerebral trauma has been made in our laboratory, parallel with investigations on the effect of x-ray-induced damage. These different, but complementary, studies can profitably be compared when seeking cytologic alterations that might be specific for ionizing radiation. With our present knowledge, it is not possible to be dogmatic about the significance of observations which, though the result of examining many

hundreds of microphotographs, still are based on alterations in only a relatively small number of cells from limited areas. Nonetheless, it appears that in areas of necrosis following x-radiation there is a depression of phagocytic elements in number and activity. Thus, from areas of total traumatic necrosis, the macrophages are filled with vacuoles and inclusions, while in regions of correspondingly complete x-ray induced necrosis, the phagocytes are fewer and their phagocytic function less prominent. It is possible that ionizing radiation affects the ability of macrophages to proliferate in and around a necrotic area, as well as altering the enzymes involved in the breakdown of phagocytosed material. (auth)

23486 BIOELECTRIC EFFECTS OF HIGH ENERGY IRRADIATION ON NERVE. C. T. Gaffey (Univ. of California, Berkeley). p.277-96 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962. (UCRL-9799)

Isolated sciatic nerves from Rana pipiens were exposed to cyclotron accelerated beams of 455-Mev deuterons and 910-Mev alpha particles. The degree of electro-physiologic damage was found to depend on the dose of irradiation and the elapsed time from irradiation. With massive doses of alpha particle or deuterons (greater than 300 krad) the action potential of the frog's sciatic nerve was promptly suppressed. Within the range 30 to 300 krad for alpha particles and 60 to 300 krad for deuterons, the survival time of the action potential was a logarithmic function of the absorbed dose. Alpha particles were found to have twice the relative biologic effectiveness of deuterons in blocking excitation. An increase in the refractory period was manifested before conduction velocity reduction, action potential depression, latency period prolongation, and stimulus strength alteration in the high energy irradiated nerve. Alpha particle irradiated nerves were shown not to increase in sodium ion permeability for doses less than 150 krad. Between 150-200 krad the rate of Na^{22} penetration was slightly increased, while the rate of loss of Na^{22} from the nerve was decreased. Variations in the exposure rate from 0.5 to 8.0 krad per min failed to induce a dose-rate effect for alpha particles. The inhibition of neural activity resulting from alpha particle and deuteron irradiation was not reversible. A model for the neural membrane was outlined, and the action of radiation was interpreted on the basis of this model. (auth)

23487 MORPHOLOGIC AND PATHOPHYSIOLOGIC SIGNS OF THE RESPONSE OF THE NERVOUS SYSTEM TO IONIZING RADIATION. N. I. Grashchenkov (Inst. of the Higher Nervous Activity, Acad. of Sci., Moscow). p.297-314 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A review is presented of the main works published in the USSR. Physiology is developing in the USSR in such a way that exceptional attention to the nervous system has led to extensive research on morphologic and structural effects of radiation. (About 110 references.) (T.R.H.)

23488 THE USE OF ACCELERATED HEAVY PARTICLES FOR PRODUCTION OF RADIOLESIONS AND STIMULATION IN THE CENTRAL NERVOUS SYSTEM. Cornelius A. Tobias (Univ. of California, Berkeley). p.325-43 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The chronological development of techniques for use of accelerated ions in neurology are described. Methods for deep localization of lesions, production of laminar lesions, and knife-edge lesions are described. The stimulation of reflex action by alpha particles is demonstrated. (auth)

23489 EFFECT OF LOCAL IRRADIATION OF THE CENTRAL NERVOUS SYSTEM WITH HIGH ENERGY PROTONS. Bengt Andersson, Börje Larsson, Lars Leksell, William Mair, Bror Rexed, and Patrick Sourander (Univ. of Uppsala). p.345-58 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

For the past several years experiments were carried out to determine the local effect on the central nervous system of high-energy protons. The irradiations were performed on rats and goats with a 185-Mev proton beam from the 230-cm synchrocyclotron at Uppsala. The experiments have shown that it is possible with high-energy protons to produce small, well-circumscribed lesions at a desired site in the brain without damaging surrounding tissue. The importance of perferring long-term experiments to determine the late effects of high-energy protons on the brain is stressed. (auth)

23490 PRODUCTION OF LAMINAR LESIONS IN THE CEREBRAL CORTEX BY DEUTERON IRRADIATION. Leonard I. Malis, Jerzy E. Rose, Lawrence Kruger, and Charles P. Baker (Mt. Sinai Hospital, New York; Johns Hopkins Univ., Baltimore and Brookhaven National Lab., Upton, N. Y.). p.359-68 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A study was made of the use of a moderate energy cyclotron beam in investigation of connection and functions of the cerebral cortex. Laminar lesions produced by a 20-Mev deuteron beam are shown. The irradiation arrangement is described. Relation of peak dose to histological finding is discussed. (T.R.H.)

23491 FLUORESCEIN AS A SENSITIVE, SEMIQUANTITATIVE INDICATOR OF INJURY FOLLOWING ALPHA PARTICLE IRRADIATION OF THE BRAIN. D. C. Van Dyke, P. Janssen, and C. A. Tobias (Univ. of California, Berkeley and Armed Forces Inst. of Pathology, Washington, D. C.). p.369-82 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Soluble fluorescein U.S.P. (Uranine), a dye routinely used by physicians as a convenient and sensitive indicator of damage to corneal epithelium, has been found to be an equally convenient, semiquantitative, and sensitive indicator of injury to brain tissue following localized irradiation with a beam of alpha particles from the 184 in. cyclotron. Permeability of the tissue to fluorescein represents a physiologic or biochemical alteration of the cell, which occurs before any morphologic changes demonstrable by light microscopy. The time of onset and intensity of fluorescein staining are different for different doses of irradiation. The minimum effective dose was 5,000 or 6,000 rad. A species difference in radiosensitivity of brain tissue was demonstrated both by the fluorescein technique and by histologic morphology. The brain of rabbits and monkeys is considerably more sensitive to alpha particle irradiation than is that of rats. (auth)

23492 PATHOLOGIC CHANGES IN THE BRAIN FROM EXPOSURE TO ALPHA PARTICLES FROM A 60 INCH CYCLOTRON. Peter Janssen (Univ. of California, Berkeley and Armed Forces Inst. of Pathology, Washington, D. C.), Igor Klatzo, Jaime Miquel, Tor Brustad, Albert Behar, Webb Haymaker, John Lyman, Julian Henry, and Cornelius Tobias. p.383-409 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A study was made of the effects on the cerebellum and cerebrum of alpha particles with an energy of about 12 Mev per nucleon at surface doses of 50 to 6,000 rad, and of pro-

tons of the same energy at a surface dose of 6,000 rad. The dorsal surface of much of the cerebellum and cerebrum was exposed. The maximal tissue dosage was approximately 5 times that at the brain surface. No essential differences were observed in the alterations produced by alpha particles and those produced by protons. The width of the zone of damage in the cortex of both the cerebellum and cerebrum corresponded to the amount of energy given off by the particles as expressed by the Bragg curve. Granule and Purkinje cells of the cerebellum and nerve cells and glia in the cerebral cortex were highly radiovulnerable. The greater width of the band of damage in the cerebrum than in the cerebellum and the observation that at the lowest effective radiation dose (1,500 rad at the brain surface) a band of nerve cell loss was found in the cerebrum but not in the cerebellum suggested that the cerebral cortex was the more radiovulnerable. From other standpoints, however, the cerebellar granular layer seemed the most radiovulnerable. Nerve cell and glial damage was incurred before circulatory or permeability disturbances were evident, strongly suggesting direct irradiation of cellular elements as the primary factor in pathogenesis. At subsequent stages circulatory changes and increased vascular permeability contributed to the extent of the lesions. No lesions were encountered after as long as 7 months at surface doses of 50, 250, and 750 rad. The earliest times at which damage to cellular elements was observed following exposure at other surface doses were as follows: at 1,500 rad, 7 months (in cerebrum alone); at 3,000 rad, 20 days; at 6,000 rad, 6 hours; and at 12,000 rad, 3 hours. (auth)

23493 SOME OBSERVATIONS ON RADIATION EFFECTS ON THE BLOOD-BRAIN BARRIER AND CEREBRAL BLOOD VESSELS. Carmine D. Clemente (Univ. of California, Los Angeles and Veterans Administration Hospitals, Los Angeles and Sepulveda, Calif.), Harold E. Richardson, Jr. p.411-28 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A study was made of the reactivity of the vasculature in the brain and spinal cord to ionizing radiations. Studies dealing with the influence of x-rays on the blood-brain barrier were reviewed, and pathologic changes in central nervous system blood vessels due to x-rays and to alpha particle radiation were described. It is felt that x-radiation dosages under 1,000 r administered to the brains of adult animals fail to reveal marked histopathologic findings, even though these have been observed following this radiation dosage in newborn animals. Nevertheless, the effect of these relatively low doses may become manifested in neutral dysfunction through changes in the surrounding medium of neuronal pools. Thus, one of the effects of low dosage radiation is an increase in the permeability of cerebral vessels. With higher x-ray doses (4,500 or 6,000 r) and with alpha particle radiation (10,000 rad) to the central nervous system, histopathologic findings have been observed not only in the cerebral vasculature, but also in neurons and neuroglia. Vascular damage was evident by thickening and hyalinization of the vessel walls. Perivascular infiltration of leukocytes and complete occlusion of larger and smaller vessels were often observed. Neuronal damage was evident by morphologic changes in the cytoplasm and nuclei of remaining cells and by spongy loss of neuronal elements in the areas irradiated. Neurons showing vacuolization and ghost cells were frequently observed. Although at these higher dosages it was difficult to maintain that the neuronal pathology was only the direct result of altered circulation, it is felt that vascular pathology cannot be underestimated in an analysis of the response of the central nervous system to ionizing radiations. (auth)

23494 CHEMICAL AND ENZYMATIC CHANGES IN NERVE CELLS IRRADIATED WITH HIGH ENERGY DEUTERON MICROBEAMS. Wolfgang Zeman, Howard J. Curtis, Dante G. Scarpelli, and Ruth Kleinfeld (Indiana Univ., Indianapolis; Brookhaven National Lab., Upton, N. Y. and Ohio State Univ., Columbus). p.429-39 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

It has been shown that the direct radiation injury of nerve cells is associated with the occurrence of proteolytic enzymes within the nerve cell cytoplasm. (auth)

23495 TOLERANCE OF CENTRAL NERVOUS SYSTEM STRUCTURES IN MAN TO THERMAL NEUTRONS. L. E. Farr, W. G. Calvo, Y. L. Yamamoto, E. E. Stickley, W. Haymaker, and S. W. Lippincott (Brookhaven National Lab., Upton, N. Y.). p.441-58 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

In the histologic studies of serial sections of the brains of 17 patients treated by neutron capture therapy for intracranial neoplasms, no changes consistent with and attributable to exposure with thermal neutrons were found in the nervous tissue. A maximum thermal neutron exposure of 1.73×10^{13} thermal neutrons per square cm occurred over a 200 sec interval. One additional patient receiving only thermal neutron exposure (approximately 4.7×10^{11} thermal neutrons per square cm to the brain surface) showed no histologic changes attributable to the neutron exposure in either neoplastic or normal brain tissue. The difficulties in transposing the observed neutron exposure intensities into rad units are discussed. (auth)

23496 REVIEW OF NEUROPHYSIOLOGIC AND PSYCHOLOGIC RESEARCH ON IRRADIATION INJURY IN THE U.S.S.R. Walter R. Stahl (Oregon State College, Corvallis and Univ. of Oregon, Portland). p.469-88 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A review is presented of Soviet work up to August 1960. Clearly any definitive statement about CNS sensitivity must go into considerable detail concerning the mechanism involved and the form of sensitivity under consideration. A final conclusion concerning CNS radiosensitivity must also take cognizance of certain clinical observations on radiation exposures, namely: persons receiving even high doses feel no pain and only equivocal mild sensations; humans getting doses of 500-1,000 r do not ordinarily show any obvious neurologic disturbances, and treatments directed at the nervous system have not been helpful in combatting radiation sickness. Many ordinary virus infections appear to produce more obvious encephalopathy than radiation, and numerous chemicals now used in the environment might evoke CNS reactions as great or greater than those seen after radiation exposures at moderate levels. Not all Soviet radiobiologists place special stress on CNS mechanisms in radiation sickness. They point out, however, that the nervous system is a major organ system and ought to be given attention in radiation studies. During the last two years, there has been a relative decrease in the Soviet literature of papers stressing CNS effects, particularly those works citing the formal Pavlovian view on the pathophysiology of radiation sickness. Following exploration for damage from radiation, certain interesting questions of basic biology have now become apparent in connection with CNS radiation exposures. (auth)

23497 GENERAL SURVEY— FUNCTIONAL CHANGES IN THE NERVOUS SYSTEM INDUCED BY IONIZING RADIATIONS. Paul S. Henshaw (U. S. Atomic Energy Commission, Washington, D. C.). p.489-502 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A survey is made on the effects of different levels of radiation exposure on the nervous system as an information processing device. Features which seem to have particular meaning in relation to functional changes are then considered. Attention has been called to biologic processes as energy mechanisms. Central components of life mechanisms have been designated as: adaptiveness, meaning capability of ecoentities to perform; ecoforce, meaning degree of organization for biologic function; and deterrent influences, meaning all forces acting to reduce the organization for life. As a theorem, it is stated that adaptiveness varies directly with ecoforce and inversely with deterrent influences. By relating the central components of biologic mechanisms logically and taking into account the precise nature and relative influence of each, a ground work is laid for systematic assessment of residual capabilities in ecoentities of any level of organization, with or without irradiation. Analysis of the effects of low level environmental radiation on the nervous system yields a double return; in addition to contributing to an understanding of the practical problem of irradiation hazards to individuals and population groups, it provides fundamental information about the operational character of the nervous system. Preliminary findings that appear to have meaning are: (a) the older the fetus, the greater the dose required to produce decrements in learning, suggesting that since cerebral cellularity appears to vary correspondingly, learning must somehow be associated with the number of cells in the adult brain; (b) improvements in certain performance capabilities following irradiation, upon careful analysis may be found to stem from reduced distractability, a deleterious rather than a beneficial effect; (c) the more refined the techniques used and the more complex the nervous system studied, the easier it is to demonstrate a radiation-induced modification, suggesting that the advanced human nervous system may be more easily affected by radiation than the nervous systems of other species; and (d) late effects, consisting mainly of altered rates of degenerative changes, are difficult to demonstrate, requiring time-consuming and costly techniques. (auth)

23498 ACUTE CENTRAL NERVOUS SYSTEM SYNDROME OF BURROS. Daniel G. Brown, Daniel P. Sasmore, and Larry P. Jones (Univ. of Tennessee-AEC Agricultural Research Lab., Oak Ridge, Tenn.). p.503-11 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Three irradiation experiments with burros showed pronounced central nervous system disturbances and death at relatively low dose levels. The data suggest that vascular changes contributed greatly to the central nervous system effects observed. (auth)

23499 EFFECTS OF LOW LEVEL RADIATION ON AUDIOGENIC CONVULSIVE SEIZURES IN MICE. Dorothea Starbuck Miller (Univ. of Chicago). p.513-31 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The audiogenic seizure response appears to be remarkably radiosensitive in DBA mice and in hybrid generations derived from crossing DBA with C57 mice. A striking increase in susceptibility to aduiogenic seizures has been observed following exposure to very low doses of ionizing radiation. Heightened susceptibility is indicated by an increase in frequency and severity of seizures, by a higher percentage of total and fatal seizures on the first trial, and by shorter latency of fatal seizures. In these mice, which are tested for sound sensitivity at 30 days of age, chronic exposure to gamma radiation from birth throughout the 30 days, at a total dosage of 0.14 r, caused a significant increase in seizure susceptibility. In mice exposed to Co^{60} between days 23 and 30, a dosage of 350 mrad per day (total, 1.5-2 rad) resulted in heightened susceptibility. In DBA/2 mice, the effect of glutamic acid in protecting them from seizures was negated when the animals were maintained in an environment of 4.8 mrad per day (5-10 times background). Evidence was presented indicating that the level of radioactive fallout from April 1957, through 1959, was sufficient to enhance the frequency and severity of seizures. In addition to the primary physiologic effect on the seizure response, evidence of genetic change affecting seizure susceptibility in both DBA/1 and C57BL6 was noted following chronic exposure to gamma radiation at 5-10 times background. (auth)

23500 EFFECTS OF IONIZING RADIATION ON VISUAL FUNCTION. Leo E. Lipetz (Ohio State Univ., Columbus). p.533-42 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A review is presented of findings in vision research applicable in radiobiology. The visual system is an example of how response of a biological system to a stimulus is determined by the organization of the system. An appendix with data tables is included showing the effects of high-energy radiation on the visual function. (T.R.H.)

23501 X-IRRADIATION STUDIES ON THE MAMMALIAN RETINA. Werner K. Noell (Roswell Park Memorial Inst., Buffalo). p.543-59 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The effects of various x-ray beams on rabbit's eyes were studied by electroretinography. The outstanding result of these studies is the close association of visual cell death from x-irradiation with the effects on the sensory function of this cell and on energy-yielding metabolic activities. With the exception of the photoexcitatory action of x-rays, all effects required about the same critical dose. They all seemed to develop at about the same time, as if the whole cell in all aspects of its function suddenly failed. It thus would appear that x-irradiation affects a critical region of the cell, a region on which all the measured activities intimately depend. The visual cell characteristically comprises several distinct compartments, each probably having its own distinct function. If this critical region of x-ray action were the nuclear region, then the fact that the ERG disappeared within a few minutes (its main components disappearing simultaneously) would be difficult to understand, since it is well established that the a-wave is closely related to the integrity of function of the outer segment, and not so much to that of the more proximal parts of the visual cell. On the other hand, were the outer segment the essential site of the action of x-irradiation, a close association of the ERG effect with cell death would be improbable because destruction of the outer segment is compatible with visual cell survival. The only region of the visual cell which intimately might support all other parts of the cell and their functions is the distal portion of the inner segment to which the mitochondria of the cell are confined. The difficulty in assuming that this is the "critical" region derives from the well supported finding that poisons which affect the respiratory chain, and anoxia, have notably little

capacity to produce visual cell death. The visual cells of the rabbit, for instance, survive ocular ischemia lasting 75 minutes. In view of these difficulties in defining a "critical" region, it seems more probable that x-irradiation affects a dynamic system which is essential everywhere in the cell and which structurally may be represented by the plasma membrane or cytomembranes. Whatever the system or cell component which x-irradiation affects in the visual cell, a similar or the same system must be an important site of action of x-irradiation throughout the nervous system. (auth)

23502 THE EFFECTS OF IONIZING RADIATION ON SPINAL CORD NEURONS. Makoto Sato, George Austin, and Walter Stahl (Univ. of Oregon, Portland). p.561-72 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Using decerebrated cats, the acute effect of ionizing radiation on the neural elements of the spinal cord was investigated preliminarily. Monosynaptic reflex showed a considerable increase in amplitude immediately after the initial irradiation with 500 r, while the intramedullary spike activity of sensory fibers ascending dorsal column decreased gradually in amplitude with successive irradiation. N_1b wave (interneuronal activity) did not show a significant change in amplitude. Extracellular response from the afferent fibers showed a gradual decrease in amplitude immediately after an initial dose of 1,270 r. Intracellular response from afferent fibers did not show a significant change in amplitude even after irradiation with 10 kr. Intracellular response from interneurons did not seem to be affected even by irradiation with 10 kr. Extracellular response from motor neurons did not show a significant change in amplitude or in time course for either orthodromic or antidromic stimulations, at least within the first 2 hours after the irradiation at 3,850 r. Thereafter, however, it showed a remarkable increase in amplitude and stayed almost constant more than 1 hour. Intracellular responses from motor neurons evoked by orthodromic and antidromic stimulations were not affected significantly, even by irradiation of up to 12 kr, except for a few cases which showed a slight increase in amplitude. From these results, it is inferred that myelinated nerve fibers and cell somata in the mammal have a considerable safety factor for the acute effect of irradiation up to 14 kr. It is inferred that the sensory nerve is more sensitive to irradiation than the motor nerve, and it is suggested that interneuronal inhibitory passway might also be relatively sensitive to irradiation. (auth)

23503 RADIATION EFFECTS ON BIOELECTRIC ACTIVITY OF NERVES. C. S. Bachofer (Univ. of Notre Dame, Indiana). p.573-96 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The ventral caudal nerves of the rat, the median and lateral giant nerve fibers of the earthworm, and the median giant axons of the lobster were subjected to x-irradiation in vitro. The ventral caudal nerves of the rat were also subjected to x-irradiation in situ. The giant fibers of the earthworm were, in addition, subjected to UV irradiation. Various electrophysiologic responses were observed before, during, and, in some cases, after irradiation. Electrical stimulation was used to evoke propagated impulses, and measurements were made of amplitude and rate of rise of the action potential, conduction velocity of the propagated impulse, sensitivity of the nerve to stimulation, and relative refractory period. Photographic records of oscillographic traces were projected for measurement and analysis. The pattern of response for all nerves was essentially the same during irradiation, whether the nerve was irradiated with x-rays or with UV. In response to external stimulation during irradiation, all nerves showed an increase in activity initially, a period of enhanced activity, a fall in activity, and, ultimately, cessation of activity. The degree of enhancement observed was not the same for all activities, nor did the time of maximum enhancement coincide for all activities. Spike amplitude, for example, consistently showed great enhancement, whereas conduction velocity inconsistently showed slight enhancement. Enhancement of activity, attributable to bombardment with x-rays or with UV, rarely observed in biologic investigations of this sort, was followed by deterioration of activity and eventual blocking of activity, representative of the lethal action of irradiation commonly observed. The time at which maximum activity of one factor occurred did not coincide with the time at which the maxima of other activities occurred; spike amplitude, for example, was observed to increase, while conduction velocity had already reached its maximum and was rapidly declining. The energy supplied by bombardment with x-rays or with UV did not act synergistically during the enhanced response; that is, concomitant irradiation was not necessary to produce the enhanced response, once the nerve had been altered by irradiation. Once the nerve was responding in an enhanced manner, cessation of irradiation for short periods had no effect on the response. In certain types of experiments, the response would continue to rise if it was in the rising phase when irradiation was stopped, and continue to fall if it was in the falling phase. The rise or fall proceeded at slower rates when irradiation was stopped. Stimulation at higher frequencies considerably reduced the enhancement of spike amplitude attributable to x-rays, showed a somewhat lesser effect on enhancement of sensitivity, and showed no effect on enhancement of conduction velocity. Nerves under both stimulation and irradiation failed to respond as long as nerves under irradiation alone. Stimulation apparently imposed an additional stress on the nerves. The magnitude of enhancement of activity was dependent on dose rate. At low dose rates the enhancement was greater than at high dose rates. It was possible to increase the dose rate to the point that no enhancement was observed. (auth)

23504 ALTERATION OF MAMMALIAN NERVE COMPOUND ACTION POTENTIALS BY BETA IRRADIATION. Edgar L. Gasteiger (Univ. of Rochester, N. Y.) and Berry Campell. p.597-605 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The compound action potentials of cat sural, saphenous, and vagus nerves were recorded during irradiation of a short length of the nerves with beta rays from a small bulb filled with radon. For sural and saphenous nerve fibers, the order of decreasing sensitivity to irradiation was delta, gamma, and beta. Less conclusive results show the C fibers to be less than or equal to the deltas in sensitivity, but greater than the betas. Slow fibers (delta and B) of the vagus nerve were more sensitive than the fast A fibers. The vagal C fibers were less sensitive than the A and B fibers. (auth)

23505 ACTION OF GAMMA RADIATION ON ELECTRICAL BRAIN ACTIVITY. Marcel Monnier and P. Krupp (Universitit, Basel). p.607-19 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The heads of rabbits were gamma irradiated at various doses and observations and photographs were made before

and after. Brain electric activity was studied by a stereotoxic method. In opposition to the previous conception that the brain shows a marked resistance to ionizing radiations, the present results prove that weak gamma irradiation produces transitory, reversible alterations in this organ. Weak irradiation of the head in the rabbit (400 r, 600 r) is followed by hyperactive motor behavior with oral patterns, activated EEG with desynchronization in the neocortex, activation of the reticular ascending system, and activation of the archicortex with precritical discharge of spike potentials in the hippocampus. These observations agree with results of whole body irradiation (400 r) in the cat: transitory discharge of spike potentials in the hippocampus and amygdaloid nucleus, increased arousal rhythms in the cortex. On the contrary, a stronger gamma irradiation (900 r) of the rabbits head moderates the cortical activity (high voltage slow wave syndrome), whereas a precritical hyperactivity persists in the hippocampal archicortex. Similarly, x-irradiation of the head (1,500 r) in the monkey is followed by slow brain activity. The reversibility of the electroencephalographic symptoms, namely of thalamocortical effects, observed after weak irradiation suggests an early action of gamma radiations on neuronal and synaptic activities at cortical level. (auth)

23506 EFFECTS OF RADIATION ON THE CENTRAL NERVOUS SYSTEM AND ON BEHAVIOR—GENERAL SURVEY. Harry F. Harlow (Univ. of Wisconsin, Madison). p.627-44 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Both the peripheral and central nervous system is resistant to radiation anatomically, physiologically, and psychologically as is shown in the literature. Extensive studies of radiation effects on behavior are cited. (T.R.H.)

23507 LEARNING BEHAVIOR OF RATS GIVEN LOW LEVEL X-IRRADIATION IN UTERO ON VARIOUS GESTATION DAYS. Sylvan J. Kaplan (Texas Technological Coll., Lubbock). p.645-57 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

In two learning experiments, 114 normal control and prenatally irradiated albino rats were divided into two age groups (90 and 400 days) at the beginning of psychologic testing. All subjects were trained to a criterion of learning of 4 out of 5 consecutive errorless trials on a Lashley III maze. Then 59 were randomly selected from their respective radiation and control groups and trained on a bar pressing instrument to measure experimental conditioning and extinction ability. The results indicated that while the data obtained from the maze study yielded differences between groups receiving various doses of irradiation at differing periods in utero, data obtained from the conditioning study did not. No differences were found in the two groups of normal controls, but the older irradiated animals exposed to 25-100 r were found to be significantly inferior to normal control groups in maze learning ability. Learning deficit was prominent in the 90-day-old groups only where conditions included 50 r at 7.5 days and 150 r at 8.5 days. A 90-day-old group given 200 r at 1.5 days was not adversely affected in learning in comparison to controls. The results lend credence to the hypothesis that magnitude of dose has a functional relationship to relative radiosensitivity of tissue at all periods throughout gestation, the function being revealed on the dimension of the age at time of testing. (auth)

23508 EFFECTS OF NEONATAL IRRADIATION ON LEARNING IN RATS. Billey Levinson (Univ. of Buffalo). p.659-68 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Neonatal rats were radiated at three levels of radiation at either 2, 4, or 6 days of age. Half of these animals received pretreatment with AET, a chemoprotective agent. Measures of maze learning behavior, mortality, and body weight were obtained. Acquisition and retention of the maze habit were inversely related to radiation dose. However, the group receiving AET pretreatment performed significantly better than the unprotected groups. Indeed, the original maze performance of the protected group was hardely distinguishable from that of nonirradiated animals. The protective effect of AET on both original learning and retention measures was most striking at the highest radiation level (275 r). In addition to evaluation of the chemoprotective effects, the study served to extend the data of a previous experiment on the effects of neonatal irradiation. The present data were consistent with the previously reported relationship between dose level and performance deficit and with the finding that time and error measures are more sensitive indicants of radiation effects. It was again found that radiation in the first 6 days of life produces significant decrements in adult learning. The mortality was directly proportional to radiation dose; however, rats receiving AET had a higher survival rate. Weight at 45 days of age decreased as radiation dose increased, and the chemoprotective effect on mortality and weight was observed only for the highest radiation dose. Recent studies have measured chemoprotection in terms of reduction of radiation lethality, survival time, depression of blood forming organs, number of cataracts, splenic atrophy, epilation, and graying of hair. The present study demonstrated the importance of measuring the effectiveness of chemoprotection in yet another way—by means of behavioral testing. (auth)

23509 BEHAVIORAL EFFECTS OF CRANIAL IRRADIATION OF RATS. William J. Arnold (Univ. of Nebraska, Lincoln). p.669-82 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A summary is presented of the results of a series of experiments, carried out over a period of several years, dealing with the effects of irradiation on a variety of behavioral processes, including emotionality, maze learning and retention, instrumental learning, discrimination learning, formation of a learning set, motivation, visual exploration, and general (locomotor) activity. Each rat was individually irradiated in a lead exposure chamber. For some experiments, the whole head of the rat was exposed to 300, 800, 2,000 or 2,500 r, while, for other experiments, only an oval area (11 × 13 mm) directly over the brain was exposed to 5,000 r. (auth)

23510 RADIATION-CONDITIONED BEHAVIOR. Donald J. Kimeldorf (Naval Radiological Defense Lab., San Francisco). p.683-90 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The observation that food and water consumption in rats decreased during irradiation periods but not between exposures suggested a conditioning of behavior. A study was made using sham irradiations and a distinctive taste cue. It was possible to demonstrate that radiation exposure can instigate learning and that stimuli associated with exposure can become determinants of post irradiation behavior. (T.R.H.)

23511 BEHAVIORAL AND CORRELATED HEMATOLOGIC EFFECTS OF SUBLETHAL WHOLE BODY IRRADIATION. T. C. Ruch, Walter Isaac, and Robert W. Leary (Univ. of Washington, Seattle). p.691-703 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Behavioral and hematologic effects of single dose, whole body irradiation in the sublethal range (300–500 r) were studied. No deaths or visible pathologic lesions were produced within the experimental period (63 days). Food and water intake was depressed in the immediate postirradiation period. Random cage activity was depressed 2 or 3 weeks after irradiation. The results of a test of object manipulation were equivocal. The number of red blood cells and the amount of hemoglobin dropped rather precipitously and remained depressed, to some degree, for weeks. Total leucocytes, neutrophils, and lymphocytes were markedly altered at this level of radiation damage. A distinctive sequence of increase and decrease for each cellular component occurred. A late neutrophilia was manifested 6 to 7 weeks after irradiation. Its degree appeared to be inversely proportional to the decrease in the preceding weeks and directly proportional to the radiation dosage. (auth)

23512 PERFORMANCE OF MONKEYS BEFORE AND AFTER IRRADIATION TO THE HEAD WITH X-RAYS. Roger T. Davis (Univ. of South Dakota, Vermillion) and Arnold A. McDowell. p.705-18 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

The findings broadly indicate the course of damage to the central nervous system by ionizing radiations, suggest relevant areas for further research, and aid in the understanding of the syndrome that results from whole body radiation. It is clear that x-ray radiation to parts of the heads of monkeys, in two 3,000 r doses spaced a month apart, does not have the same effect on performance as surgical insult to comparable areas of the brain. Effects similar to those found in brain-injured monkeys do appear, however, among monkeys that survive a year or more. This is in accord with the report of long latencies between irradiation and histologic changes in the brain. The present study indicates that damage from irradiation of the central nervous system is manifest earliest as disturbances of movement, activity, and visual survey. The elevator task requires subjects to make delicate, two-handed, coordinated movements and is the only task to differentiate the performance of subjects in the experimental and control groups. Subjects given radiation to the frontal lobes showed hyperactivity within a few days after irradiation. It is indicated that Soviet investigators noted hyperactivity in animals irradiated in the head. Subjects in the AP group have more visual survey after irradiation than before. The present study also provides evidence showing that visual survey is greatly augmented by an unfamiliar environment—our monkeys appeared to be constantly monitoring the setting that contained no monkeys, many investigators, and nothing to hide behind or under. Reviewing the syndrome that results from whole body radiation with 300–500 r suggests that some of the changes may be due to radiation effects on the central nervous system. The salient features of the syndrome include lowered distractibility, changes in posture, focalization of attention, relative decrease in initiation of aggression, and relative decrease in manipulation of inanimate objects. These changes and the changes which follow radiation to the head in the present study are the type of variation that would be expected if central nervous system integrative functions were impaired. Other facets of the whole body radiation syndrome, such as relative increase in self care and changes in preferences for foods, are probably related to damage of non-nervous tissue. The present study suggests that differences between the results obtained by Western and Soviet investigators may be less than heretofore supposed. Both studies showed that after irradiation of the central nervous system, impairment of movement is more prominent than impairment of complex learned responses. The design and statistical treatment of data by Soviet physiologists is vague, but possibly the conditioned response is a more sensitive tool for the detection of integrative disturbances of the central nervous system than complex learned behavior. (auth)

23513 SOME BEHAVIORAL EFFECTS OF IONIZING RADIATION ON PRIMATES. Arthur J. Riopelle (Yerkes Labs. of Primate Biology, Orange Park, Fla.). p.719-28 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

A review is presented of studies at Yerkes Laboratory on the behavioral effects of radiation in chimpanzees. (T.R.H.)

23514 SOME EFFECTS OF RADIATION ON PSYCHOLOGIC PROCESSES IN RHESUS MONKEYS. W. Lynn Brown and Arnold A. McDowell (Univ. of Texas, Austin). p.729-46 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962.

Research on relations of radioinduced changes in distractibility to performance on selected laboratory tasks. Rhesus monkeys were given chronic whole-body exposures to mixed doses from a neutron-gamma source and from a nuclear explosion at the Nevada test site. Radiation for both field and laboratory exposed monkeys produces decreased distractibility or increased concentration. The general resultant for learning is facilitation of performance on tasks placing a premium on attention to the site of food reward and decrement in performance on tasks requiring attention to peripherally placed stimuli. (T.R.H.)

Radiation Sickness

23515 (AD-269983) THE SYNTHESIS OF POTENTIAL ANTI-RADIATION AGENTS. Annual Progress Report, January 1, 1961–December 31, 1961. Henry G. Mautner (Yale Univ., New Haven. School of Medicine). Contract DA-49-193-MD-2106. 7p.

Work concerned with the preparation of compounds in which the radioprotective 2-mercaptoethylamino grouping is attached to purines and pyrimidines, potentially capable of carrying it into nucleic acids, was completed. Since replacement of the sulfur of cysteamine with selenium does not destroy anti-radiation activity, the selenium analogs of a group of 2-aminoethylthiouronium salts, as well as their presumable physiological rearrangement products (2-aminoselenazolines and 2-selenoethylguanidines) were prepared. The bis Bunte salt of bis (2-mercaptoethyl) amine the doublearmed analog of cysteamine was synthesized. (auth)

23516 (JPRS-13639) THE POLAROGRAPHIC ACTIVITY OF BLOOD SERUM PROTEINS DURING ACUTE RADIATION SICKNESS AND THE PROPHYLACTIC ADMINISTRATION OF PROPYL GALLATE. V. A. Baraboi (Baraboy) and S. A. Bershtein (Bershteyn). Translated from Ukrain. Biokhim. Zhur., 34: 32-8(1962). 10p.

Regular changes were demonstrated in the polarographic activity of serum proteins under the influence of irradiation. A marked reduction in the activity during the first hours after irradiation was replaced by transitory increase in activity, after which there was again a reduction which lasts up to the time of death of the animals. The prophylactic injection of propyl gallate initially intensifies the inhibition of activity of serum proteins, but the ensuing

increase in this activity is not replaced by a new reduction, but rather leads to a complete restoration of it by the eighth day after irradiation. The intensification of the radiation inhibition of the polarographic activity of proteins under the influence of propyl gallate is the result of the summation of two different processes: the radiation inactivation of protein and the reversible suppression due to blockade of its active groups. The inhibitory effect of propyl gallate consists in converting the active groups of the serum proteins to inactive groups, which are more radioresistant, which in turn is responsible for the restoration of the amplitude of the polarographic waves to their original levels. (auth)

23517 THE PROTECTIVE EFFECTS OF AMINOETHYLISOTHIOUREA AGAINST IONIZING RADIATIONS AND ITS TOXIC EFFECTS ACCORDING TO THE AGE OF THE WHITE MICE. A. M. Roussanov and G. S. Novoselova (Institut Central de Radiologie Medical, Leningrad). Ann. Radiol., 5: 225-9(1962). (In French)

The protective effects of the bromohydrate of s-β aminoethylisothiourea (AET) against ionizing radiations are studied. The toxic properties of AET on white mice at various stages of their development are also investigated. It was established that the most resistant are newborn mice with DL_{50} = 520 γ/g, and the least resistant are mice between 2 and 3 weeks old with DL_{50} = 335 γ/g. After the age of three weeks, the mice once more become more resistant to AET, but 6- to 7-week-old mice are less resistant (DL_{50} = 425 γ/g) than adult mice (DL_{50} = 475 γ/g). The divergent reactions, according to the stage of their development, are also established for the protective action of AET during whole-body irradiation with lethal x-ray doses of 600, 650, and 700 r. The smallest percentages of survivals among mice protected to the 30th day after irradiation is seen in mice of ages 2 to 3 or 6 to 7 weeks (37 and 42%, respectively), but the highest percentage of survival is found for newborn mice (59%) and adult mice (71%). The mean life span in protected mice is 2 to 2.5 times as great as in unprotected mice. The peculiarities in the reactions of the animals according to the stage of their development must be taken into consideration during the use of chemicals as protective agents in the prophylaxis of radioinduced lesions. (auth)

23518 RESTORATION OF SOME INDICES OF THE FUNCTIONAL STATE OF CUTANEOUS VESSELS IN MONKEYS AT REMOTE PERIODS AFTER THE RADIATION SICKNESS. V. V. Yakovlev. Byull. Eksptl. Biol. i Med., 3: 34-8(Mar. 1962). (In Russian)

A study of the tone of arterial vessels in monkeys at various intervals after acute radiation sickness has demonstrated that this index of the state of cutaneous vessels and the temperature of the skin undergo characteristic changes. These two indices become normalized within the first three years only if the dose was not greater than 300 r, whereas with a dose of 600 r, skin temperature and arterial tone become normalized only in 4 to 5 years. (auth)

23519 HISTOCHEMICAL CHANGES IN THE ENTEROCHROMAFFIN CELLS OF DUODENUM IN ACUTE RADIATION SICKNESS. N. M. Nemenova, V. M. Manteifel, and G. A. Chernov. Byull. Eksptl. Biol. i Med., 3: 109-12(Mar. 1962). (In Russian)

A reduction of the number of enterochromaffin cells (Kulchitsky's cells) and of chromaffin granulations in them was noted in the duodenum of guinea pigs and rats after total x-ray irradiation. Maximal changes were observed during the acute stage of radiation sickness. (auth)

23520 DIVISION OF THE OOCYTE MATURATION IN THE MAMMALIAN OVARIES AT VARIOUS PERIODS OF THE ESTRAL CYCLE AND IN ACUTE RADIATION SICKNESS. V. Ya. Karmysheva. Byull. Eksptl. Biol. i Med., 53: 93-6(Feb. 1962). (In Russian)

A study was made of the oocyte maturation division in albino mice at various phases of the sexual cycle after a single total x ray irradiation in a dose of 400 r. During the period from the 2nd to the 24th day after the irradiation a rise of the number of maturing oocytes and of the corpora lutea was noted. However, maturation division was observed mainly in the degeneratively changed oocytes. Consequently, this process was enhanced as the result of radiation injury of the gonads and increased atresia. A rise of the number of ovulations evidently depends on the neuro-humoral shifts caused by the ionizing radiation. (auth)

23521 STUDIES ON THE IMMUNOLOGIC UNRESPONSIVENESS DURING THE SECONDARY DISEASE PERIOD OF LETHALLY IRRADIATED MICE PROTECTED BY HOMOLOGOUS BONE MARROW. John S. Thompson, Eric L. Simmons, and Diana Hofstra (Univ. of Chicago). J. Immunol., 89: 62-71(July 1962).

The survival of lethally x irradiated mice protected by isologous or homologous bone marrow therapy was studied. To eliminate the mortality due to primary disease the arbitrary period beginning 21 days after irradiation was chosen and survival was followed for an additional 90 days. It was observed that those groups of mice saved by homologous bone marrow consistently fared less well than those protected by isologous marrow. The i.v. administration of 10×10^6 isologous lymphocytes, spleen cells, or immune lymphocytes had no influence on this rate of mortality. Further, it was found that the immunologic unresponsiveness of mice protected by homologous marrow extended to heterologous rat red cells. Activated isologous spleen cells or lymphocytes from preimmunized mice conferred adoptive immunity to rat erythrocytes when transferred to lethally irradiated mice saved by isologous or homologous marrow. These data indicate that if donor-grafted cells still persist 21 to 28 days after irradiation of the host, they do not effectively destroy the transferred isologous tissues. The studies of other investigators were reviewed in light of these results and it is concluded that the mechanism of immunologic unresponsiveness of irradiated animals protected by foreign cells is not the same as immunologic tolerance. Since the data do not indicate a graft vs. host reaction, and cannot be interpreted exclusively as a host vs. graft reaction, an alternate hypothesis that a host vs. host reaction may be operative at times is suggested. (auth)

23522 DISTURBANCES IN THE GENERATIVE SYSTEM OF MONKEYS IN REMOTE PERIODS FOLLOWING ACUTE RADIATION SICKNESS. L. A. Yakovleva and M. I. Novikova. Med. Radiol., 7, No. 5, 31-7(May 1962). (In Russian)

Under investigation was the state of the generative function in 33 lower monkeys (24 females and 9 males) who had sustained in the past (up to 5½ years age) acute radiation sickness. In female monkeys radiation doses of 600 r and higher caused either the appearance of stable sterility or sharp derangement of their reproductive function, as the result of which pregnancy was superseded by abortion. Radiation doses of 500 r and lower in a number of cases did not prevent the appearance in the irradiated females of a normal progeny. In male monkeys even doses of 700 r were not completely sterilizing and did not prevent in some cases the birth of normal offspring. Disturbances of the

normal development in the progeny of irradiated monkeys were not followed up in the first generation. (auth)

23523 ACUTE RADIATION SICKNESS OF NEWBORN RATS AND ITS REMOTE SEQUELAE. S. L. Petrosyan and I. A. Pereslegin. Med. Radiol., 7: No. 5, 38-45(May 1962). (In Russian)

A study was made to establish the specific features of the reaction of newborns to the effect of ionizing radiation. Experiments were staged on 1035 newborn rats. Nine hundred and five newborn rats were subjected to whole-body single irradiation on the 1st to 2nd day of postnatal life; 130 rats served as control. The dose of irradiation was 50, 100, 200, 300, and 500 r. Irradiation of rats on their 1st to 2nd day of postnatal life leads to the development of radiation sickness which is most pronounced clinically with a dose of 500 r. In the survived animals, apart from retardation in weight gain, at remote periods following the irradiation there develop lordoscoliotic deformations of the thoracic portion of the spine, anomalies of the ribs with deformation of the chest, and disturbances of the ocular apparatus and generative organs. (auth)

23524 FUNCTIONAL CHANGES OF THE LYMPHATIC SYSTEM IN ACUTE RADIATION SICKNESS COMBINED WITH INJURIES OF THE OSTEOARTICULAR APPARATUS. P. K. Klimov. Med. Radiol., 7: No. 5, 45-8(May 1962). (In Russian)

Results are reported from investigations of functional changes occurring in the lymphatic system of the hind limb of rabbit, injury of the osteoarticular apparatus, acute radiation sickness (moderate severity), and in combined affections (concomitance of acute radiation sickness with fracture of the tarsus). Deviations in the lymph circulation were more marked in combined affections. They were manifested by dystonia of lymphatic vessels, retarded passage of contrast lymph, and permeability disturbances of vessels and lymph nodes. (auth)

23525 THE INFLUENCE OF HOMOTRANSPLANTATION OF FRESH BONE MARROW IN RADIATION SICKNESS COMPLICATED BY CLOSED BONE FRACTURE. G. G. Chemyanov. Med. Radiol., 7: No. 5, 49-53(May 1962). (In Russian)

In experiments staged on 58 rabbits a study was made of the curative effect of free intraosseous transplantation of fresh bone marrow in combined radiation injuries, consisting of closed fractures of the right radius against the background of acute radiation sickenss induced by total x-ray irradiation in a dose of 900 r. In combined radiation affections intraosseous bone marrow transplantation does not cause any complications associated with the technique of introduction. Transplantation of homologous bone marrow exerts a favorable effect on the hematopoietic function and alleviates the course of radiation sickness. (auth)

23526 SURVIVAL OF PLATELETS TRANSFUSED INTO THROMBOCYTOPENIC RECIPIENTS. J. R. Krevans and D. P. Jackson (Johns Hopkins Univ., Baltimore). p.355-6 of "Proc. 8th Congr. Int. Soc. Blood Transf., Tokyo, 1960." L. Hollander, ed. S. Karger Basel, New York, 1962.

Studies showed that platelets in fresh blood transfused into irradiated thrombocytopenic dogs survived normally. Platelets in stored blood lost their ability to survive in direct relation to the time of storage. Survival of fresh platelets was not adversely affected by the use of uncoated glass containers. (auth)

CHEMISTRY

General and Miscellaneous

Refer also to abstract 24581.

23527 (ANL-6519) CRYSTALLOGRAPHIC D-SPACE COMPUTER PROGRAM. M. H. Mueller (Argonne National Lab., Ill.); E. F. H. Meyer, and S. H. Simonsen (Texas. Univ., Austin). Apr. 1962. Contract W-31-109-Eng-38. 28p.

D-Space is a computer program which generates indices (hkl), tests for space-group extinctions, and calculates "d," $1/d^2$, $\sin\theta$, $\sin^2\theta$, $\sin\theta/\lambda$, $\sin^2\theta/\lambda^2$, θ, and 2θ for any crystal system and space group, requiring only the unit cell constants as data input. Optional calculations are the single-crystal angle settings, phi and chi, and various Lorentz and Lorentz-polarization corrections. (auth)

23528 (ORNL-3290) TRANSURANIUM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING FEBRUARY 28, 1962. D. E. Ferguson, comp. (Oak Ridge National Lab., Tenn.). June 13, 1962. Contract W-7405-eng-26. 92p.

The development of separation processes for the transuranium elements, process equipment development, HFIR target fabrication development, design of the TRU facility, design of development facilities, corrosion studies, analytical research and development, and the preparation of U^{232} samples for research are reported. The aluminum in HFIR targets will be transmuted to silicon at the rate of 2% per year. The rate of dissolution of aluminum in HCl solution was proportional to the cube of the HCl concentration, doubled for every 8 to 9°C rise in temperature, and was inversely proportional to the silicon content in the range 0.1 to 3% silicon. The tertiary amine solvent extraction process for separating the transuranium elements from the lanthanides was successfully tested on a laboratory scale. In a batch countercurrent test, americium recovery was >99%, with a decontamination factor of $>10^4$ from rare earths. Of the other expected contaminants, only Ti^{4+} followed the transuranium elements through the process. Separation of americium and curium from the transcurium elements by 2-ethylhexylphenylphosphonic acid was also demonstrated on a laboratory scale, with a californium recovery of >99% and <0.1% of the americium carried along in a seven-stage countercurrent extraction. An anion exchange process for recovering americium and curium from plutonium process waste was developed and successfully tested on a laboratory scale. The americium, curium, and rare earth fission products are sorbed on an anion exchange resin from 2.3 M $Al(NO_3)_3$, eluted with dilute HNO_3, converted to a chloride solution by extracting the nitrate and with a tertiary amine after addition of LiCl, and isolation of the americium and curium by amine extraction. The over-all recovery of americium was >99%, with less than 0.1% of rare earths following the product. Remote piping disconnects made by an area seal leaked less than 10^{-3} cc/sec of helium after 10 makes and breaks. Small misalignments and marks in the seating area did not cause excess leakage. A mixer-settler was adapted to permit the use of very low flow rates and phases with small density differences. The change consisted in adding submerged weirs between the settlers and mixers to prevent solvent back-mixing. An improved mixing impeller was demonstrated, and a pressurized-water fire-extinguishing system for solvent fires in gloveboxes was devised and successfully tested. Blending of actinide oxide and aluminum powder for pressing into pellets was successfully demonstrated with small rods in the blending vessel to prevent agglomeration. Pellets with pressed densities 91% of theoretical were obtained at 33 tsi. In tests of end-closure tube welding, direct current-fusion welding of a butt-joint design appeared satisfactory, although there were areas of nonfusion in the leaktight welds. Tube collapse onto the pellets could be obtained at an isostatic pressure of about 13,000 psi, but intimate contact between tube and pellets at all points was not obtained in these initial tests. Preliminary studies indicated that radiography could be used to inspect the end-closure welds. The remotely operable fabrication equipment for the TRU facility is being designed and some items are being fabricated or bought for future testing. Conceptual design of the transuranium facility is complete and Title I design is in progress. Process design studies were made on HFIR target dissolution, the solvent extraction steps, and the preparation of actinide oxides. Conceptual design of process equipment and in-cell layouts were largely completed, and equipment flowsheets and processing schedules were developed. Shielding calculations indicated that 54 in. of magnetite concrete satisfies the dose rate criteria. Experiments with shielding window configurations indicated that an oil-glass laminated window would match the 54 in. of concrete. Maximum permissible concentrations of the various transuranium nuclides were calculated and the hazards evaluated. Conceptual design of the development facilities to be installed in cells 3 and 4 of Bldg. 4507 was completed, and detailed design and procurement were initiated. In exploratory corrosion tests to select materials of construction for handling chloride solutions in the transuranium facility, six potential materials were selected: Hastelloys B and C, niobium, tantalum, titanium, and Zircaloy-2. The results of subsequent tests eliminated Hastelloy B and titanium and indicated a possible hydrogen embrittlement problem with tantalum and niobium and severe corrosion of Hastelloy C in heat-effect zones. Heat-treated Hastelloy C appeared satisfactory for most components, but either tantalum or Zircaloy-2 must be used in some corrosive situations. The effect of alpha activity at the level of 2 watts/liter on corrosion of the above materials in chloride solutions was determined to be the same as that produced by H_2O_2 addition. Eight radiochemical methods were developed and tested. All use alpha counting as the basic measurement. Preliminary work indicated that the method of Peppard can be adapted for berkelium determination. Process flowsheets for isolating U^{232} from irradiated Pa^{231} were tested and successfully demonstrated by isolating 5 mg of U^{232} from 8 g of irradiated Pa^{231}. Final purification methods for the U^{232} were developed and tested. (auth)

23529 (TID-16024) STUDIES IN SOLUTION AND NUCLEAR CHEMISTRY. Progress Report, October 1, 1961 to September 30, 1962 and Renewal Proposal, October 1, 1962 to September 30, 1962. Jacob A. Marinsky (Buffalo. Univ.). July 1, 1962. Contract AT(30-1)-2269. 100p.

A report is given of research with different ion-exchange, electrolyte systems that is being conducted to study the solution chemistry of the alkali metals, the alkaline earths, the transition elements, and the rare earth elements and to elucidate ion-exchange phenomenon. Nuclear chemistry

studies related to the fission process are also described. (M.C.G.)

23530 PREPARATION OF ^{18}O-LABELLED FURAN. Boerge Bak, Joergen Tormod Nielsen, and Marianne Schottländer (Univ of Copenhagen). Acta Chem. Scand., 16: 771(1962). (In English)

O^{18}-labeled furan was synthesized with Feist's method, using the methyl ester of 3-bromocoumalic acid as the starting substance. The product was found to be ~75% ordinary and ~25% O^{18}-labeled, and the yield was 26%. One probable mechanism is discussed. (D.L.C.)

23531 A SIMPLE APPARATUS FOR THE CARBONATION OF GRIGNARD REAGENTS WITH CARBON^{14}C DIOXIDE. Lennart Eberson (Draco, Lunds Farmaceviska A.B. Lund, Sweden). Acta Chem. Scand., 16: 781-2(1962). (In English)

A simple, closed carbonation apparatus is described which is easily constructed from commercial glass equipment. In operation, $BaC^{14}O_3$ and the Grignard reagent are added to the apparatus, the apparatus is evacuated and filled with N_2, and $HClO_4$ is added to evolve $C^{14}O_2$. Phenylacetic-1-C^{14} acid was prepared in this way. (D.L.C.)

23532 ISOTOPE RATE EFFECTS IN THE ENOLIZATION OF OXALACETIC ACID. George W. Kosicki (Univ. of Windsor, Ont.). Can. J. Chem., 40: 1280-4(July 1962).

Acid-catalyzed enolization of oxalacetic acid in H_2O and D_2O gives rise to a constant isotope rate effect k_{H_2O}/k_{D_2O} of 2.4 over the pH (pD) range of 5.5 to 7.5. Base-catalyzed enolization of oxalacetic acid in H_2O and D_2O gives rise to a constant isotope rate effect k_{H_2O}/k_{D_2O} of 4.5 over the pH (pD) range of 7.0 to 8.0. The percentage of enol form of oxalacetic acid was calculated to be 15.3% at pH 8.0, using the absorption of the enol form in ether at 255 mμ and the absorption of the keto form at pH 0.5 in an aqueous system. The spectrophotometric measurement of the isotope rate effect involved in the enolization of oxalacetic acid gives direct evidence for the rate-determining step in both the acid- and the base-catalyzed reactions without subsequent reactions. (auth)

23533 NUCLEAR MAGNETIC RESONANCE INVESTIGATION OF MOLECULAR COMPLEXES OF POLAR MOLECULES IN AROMATIC SOLVENTS. J. V. Hatton and W. G. Schneider (National Research Council, Ottawa). Can. J. Chem., 40: 1285-90(July 1962).

In order to confirm the existence of specific molecular complexes in solutions of polar solutes in aromatic solvents previously proposed, the temperature variation of the proton resonance shifts of the solutes acetonitrile, p-benzoquinone, and N,N-dimethylformamide in 5 mole% concentration in toluene were measured. The large temperature coefficients of the solute shifts observed strongly support molecular complex formation. For the same solutes dissolved in methylcyclohexane the temperature coefficients were negligibly small. The temperature at which onset of free rotation of the N-dimethyl group of N,N-dimethylformamide occurs is solvent; and concentration-dependent. These observations are consistent with the proposed geometry of the molecular complex in the aromatic solvents. (auth)

23534 PART I. EQUILIBRIUM CONSTANTS OF CADMIUM, LEAD, AND URANYL IONS IN REACTION WITH DOWEX 50 RESIN CATION EXCHANGER. PART II. MEASUREMENT OF ACTIVITY COEFFICIENT RATIOS FOR THE CELL REACTIONS Hg–Cd | $Cd(ClO_4)_2$–$HClO_4$ | Glass AND Hg–Pb | $Pb(ClO_4)_2$–$HClO_4$ | Glass. Donald Earl Jordan (Univ. of Colorado, Boulder). Dissertation Abstr., 22: 3365(Apr. 1962).

From the reaction $M^{2+} + 2ResH \rightleftharpoons (Res)_2M + 2H^+$, equilibrium quotients (K_a) obtained between Cd^{2+}, Pb^{2+}, or UO_2^{2+} ions, corrected for solution activity, and Dowex 50w–4 and 8% crosslinking show a linear plot versus equivalent fraction of metal resin ($N_{(Res)_2M}$). In each reaction, the metal ion shows a preference for the resin. The preference of the metal ion for the resin increases as the concentration of metal in the resin increases. High and low loading of the resin with metal ions show deviations from the linear curve. These deviations are considered to be mostly due to the limitations of available analytical methods. Best fit curves were estimated to compensate for the above deviations. Equilibrium quotients were corrected for resin activity by a thermodynamic treatment. Values for thermodynamic equilibrium constants (K), however, are subject to errors in the data, because no independent method for determination of the resin activity has as yet been devised except in the simple case of alkali metal ions. Thermodynamic values (ΔH, ΔF, ΔS) were calculated from equilibrium quotient (K_a) and thermodynamic equilibrium (K) data. The heat of reaction (ΔH) was determined from the change in equilibrium quotient with change in temperature for each metal. Change in free energy (ΔF) was calculated from the thermodynamic equilibrium constant (K) according to the equation $\Delta F = -RT\ln K$. The entropy change (ΔS) was calculated from ΔH and ΔF values above i.e., $\Delta S = \Delta H - T\Delta S$. Donnan exclusion experiments were carried out for the metal resins. Exclusion of anions and thus metal ions by the metal resins was quite good. However, for lead resin, anion inclusion by the resin was quite large. Exclusion characteristics showed that no complex ions formed in the resin. Electromotive force values from the reversible concentration cell

$$Hg - M \mid M(ClO_4)_2 - HClO_4 \mid Glass$$

were determined for the Cd^{2+}–H^+, and Pb^{2+}–H^+ systems. The standard electrode potential (E^0) was determined for each system by measuring the emf at several solution concentrations and plotting the emf versus $\sqrt{\mu}$. The curve was extrapolated to zero ionic strength (μ) where $E = E^0$ = standard electrode potential. Emf measurements were carried out for various known mixed concentrations of M^{2+} and H^+ for each system. The activity coefficient ratios were determined by calculation from the Nernst equation.

23535 SOLVENT AND DEUTERIUM ISOTOPE EFFECTS ON THE ORTHO-CLAISEN REARRANGEMENT. Eugene Fred Wolfarth (Ohio State Univ., Columbus). Dissertation Abstr., 22: 3415(Apr. 1962).

An investigation was undertaken to shed further light on the mechanism of the Claisen rearrangement by studying the effect of the solvent on the rate of the reaction. Since a polar transition state has been postulated for this reaction, a significant change in the rate of reaction would be expected on varying the polarity of the solvent. The rates of rearrangement of allyl p-tolyl ether were measured in 17 solvents and in the gas phase (solvent, $k \times 10^6$ sec^{-1} at 170°., ΔH^* in kcal/mole, and ΔS^* in cal/deg/mole: gas phase, 1.01, 35.07, –7.65; tetradecane, 3.01, 33.14, –9.83; di-n-butyl ether, 3.27, --, --; n-decylamine, 4.52, 32.42, –10.65; ethyl carbitol, 5.33, --, --; propylene carbonate, 9.42, 31.00, –12.39; 2-octanol, 9.65, 29.29, –16.18; adiponitrile, 10.51, 31.98, –9.97; tetramethylene sulfone, 10.66, 32.03, –9.78; 1-decanol, 11.13, 29.62, –15.15; Carbitol, 17.92, 30.11, –13.13; octanoic acid, 24.2, --, --; 2-aminoethanol, 27.1, 30.12, –12.28; ethylene glycol, 67.3, 28.93, –13.13; p-cresol, 73.1, 22.92, –26.63; phenol, 102.7, 26.32, –18.19; 28.5% ethanol-water, 107.1, 26.15, –18.48;

p-chlorophenol, 303., 22.92, −23.77). The reaction rate is seen to increase 100-fold in going from the least polar to the most polar solvent employed. These results are not consistent with an interpretation that the solvent effect is mainly dependent on the hydrogen bonding ability of the medium. However, these data are correlated quite well ($r = 0.89$) by Kosower's Z values, suggesting that the solvent effect may be attributed to the ability of the medium to stabilize a dipolar transition state. In order to investigate the solvent effect on the electrical demands of the transition state, the rates of rearrangement of four allyl p-X-phenyl ethers (X = NO_2, Br, CH_3, and OCH_3) were determined in tetradecane, Carbitol and 28.5% ethanol–water. The Hammett ρ's for the rearrangement (solvent and ρ value: tetradecane, −0.67; Carbitol, −0.61; 28.5% ethanol–water, −0.53) are compatible with the view that as the solvent stabilization of the transition state increases, there is less demand for internal electronic stabilization by the substituent. The observed data indicate that a charge-separated or dipolar transition state exists during the Claisen rearrangement. The objective of a second phase of this investigation was to demonstrate that the rearrangement step was the rate-determining step in this reaction. The Claisen rearrangement can be visualized as occurring in two successive steps: step 1, the rearrangement to the 2-allyl-3,5-dienone, and step 2, the enolization of this dienone to 2-allylphenol. By substituting the ortho-carbon atoms with deuterium, it was possible to demonstrate which step was the rate-controlling one. If step 1 were rate-controlling, the rate of reaction of allyl p-tolyl-2,6-d_2 ether would show only a small secondary isotope effect, while step 2 (the breaking of a carbon-hydrogen bond) would show a sizable primary isotope effect. Within experimental error, the rates of rearrangement of allyl p-tolyl-2,6-d_2 ether and allyl p-tolyl ether were found to be the same, indicating that step 1 is rate-controlling in the ortho-Claisen rearrangement.

23536 PART I. FLUOROCARBON FLAMES. PART II. DISSOLUTION OF URANIUM IN NITRIC ACID. John Daniel Salzman (Univ. of Colorado, Boulder). Dissertation Abstr., 22: 3429(Apr. 1962).

Part I. The phenomenon of fluorocarbon flames was investigated by: (1) attempting to produce flames by the reaction of several fluorocarbons with oxygen, chlorine, nitrogen dioxide, nitric oxide, and various mixtures of these gases in a flow system, and (2) obtaining the spectra of the flames thus produced. The fluorocarbons investigated were chlorotrifluoroethylene, 1,1-difluoroethylene, 1,2-dichloro-1,2-difluoroethylene, perfluorocyclobutene, and perfluoroisobutene. All of these compounds react with oxygen to produce luminous diffusion flames, the most intense of which is produced by 1,1-difluoroethylene. The luminosity of the flames resulting from the reaction of chlorotrifluoroethylene with oxygen is decreased by premixing nitric oxide with the fuel. In addition to producing a luminous diffusion flame, chlorotrifluoroethylene also reacts with oxygen to produce a faint, blue glow which is immediately extinguished by the presence of small amounts of nitric oxide or nitrogen dioxide. However, if chlorine is also present, small amounts of these oxides cause the glow to lapse into a series of bright flashes. On the other hand, a steady, luminous diffusion flame can be produced by the reaction of chlorotrifluoroethylene with pure nitrogen dioxide. The reaction is accompanied by the decomposition of nitrogen dioxide and the formation of soot. With most of the flames investigated, the presence of chlorine tends to increase luminosity and soot formation. The spectra of the luminous flames show thermal continua. The spectra of the chlorotrifluoroethylene flames investigated indicate the presence of a continuum which appears to be very similar to that which has been attributed to the reaction: $2Cl \rightarrow Cl_2$. Discrete emission was observed only in the spectra of the flame produced by the reaction of 1,1-difluoroethylene with oxygen and of the flames produced by the reaction of chlorotrifluoroethylene with the oxides of nitrogen. In the spectrum of the former appeared bands due to C_2, CH, and OH and lines due to Na and Si; bands due to CN appeared in the spectra of the latter flames. Part II. Various factors which influence the rate of dissolution of uranium in nitric acid were investigated by dissolving samples of the metal from ten different lots of varying analysis and metallurgical treatment under various conditions of temperature, acid concentration, and concentration of the products of the reaction. The samples which dissolved most rapidly were those with relatively high carbon and nitrogen contents. This effect appears to be augmented by the amount of metallurgical treatment that the sample has received, i.e., samples with high carbon and nitrogen analyses dissolved even more rapidly as the amount of "work" which the sample had received was increased; however, the amount of work received did not influence the rate of dissolution of samples with relatively low carbon and nitrogen contents. The effect of metallurgical treatment on the rate of dissolution is probably due to the resulting grain size of the metal, which decreases as the amount of work received is increased. Samples of metal which had been worked dissolved more rapidly along the axis of the rod from which they had been cut than in other directions. The rate of dissolution of uranium in nitric acid increases as the reaction proceeds. This effect can be prevented to some extent by increasing the rate of stirring or by the addition of urea; the rate can be further increased by addition of potassium nitrite. The increase in the rate of dissolution as the reaction proceeds is attributed to the increase in concentration of nitrous acid which is formed during the reaction and also to the increase in surface area of the metal. In nitric acid uranium behaves like a metal below hydrogen in the electromotive series. The rate of the reaction is strongly dependent on acid concentration, and the metal becomes passive in dilute acid. The maximum rate of dissolution occurs at concentrations of 13 to 14 N. The temperature dependence of the reaction is greater in 15.6 N than in 8.1 N acid.

23537 ISOTOPE GEOCHEMISTRY OF BORON. David Alt (Univ. of Texas, Austin). Dissertation Abstr., 22: 3602 (Apr. 1962).

The atomic weight of boron and the possible existence of natural variations in its isotopic composition are both matters of active controversy. This controversy seems to stem, in part, from the fact that several investigators have used boron trifluoride as a medium for mass-spectrometric analysis. Boron trifluoride is unsuitable for this purpose because it is capable of reacting with many of the components of a mass spectrometer. In order to avoid such reactions, methyl borate, the methanol ester of boric acid, was chosen for the mass-spectrometric analyses in this investigation. Boron isotope analyses were conducted on twelve samples of methyl borate in a 12-inch, 60°, single-focusing mass spectrometer. The samples were prepared from material obtained from a variety of geological environments in the hope that they would reflect the extent of natural variation in the isotopic composition of boron. The composition of the boron in the samples investigated was found to be constant within the limits of experi-

mental error. Any natural variation which exists in these samples must be less than 1.5%. Fragmentation of hydrogens from the methyl borate molecule in the mass spectrometer necessitates complex corrections to make it possible to obtain the absolute abundance ratio of the isotopes. The ratio B^{11}/B^{10} was determined to be 4.05 ± 0.10, a value which substantiates those obtained by several recent investigators.

23538 INFRARED STUDY OF THE REACTION OF POLYISOPRENE AND POLYBUTADIENE WITH SULFUR BY USE OF DEUTERATED POLYMERS. J. J. Shipman and M. A. Golub (B. F. Goodrich Co. Research Center, Brechsville, Ohio). J. Polymer Sci., 58: 1063-82(Apr. 1962).

An infrared study of the sulfur vulcanization process was carried out with very high cis polymers of isoprene-d_5, isoprene-3-d_1 and butadiene-2,3-d_2 as well as the corresponding perprotio polymers. The use of deuterated polymers permitted more definitive interpretations of the spectral changes associated with vulcanization than those previously reported or were possible with the undeuterated polyisoprene or polybutadiene. It was concluded that the 10.4 μ band which develops in the spectrum of cis-polyisoprene on extended reaction with sulfur at 140°C, and which has been the subject of some controversy, arises largely from a combination of saturated ring structures, such as cyclic sulfides, and conjugated double bonds, and to a minor extent from shifted double bonds. In addition to the processes leading to these various structures, crosslinking also occurs, but it apparently produces no important changes in the spectra of the polyisoprene vulcanizate other than that associated with a decrease in the original unsaturation. Polybutadiene, in contrast to polyisoprene, undergoes extensive cis-trans isomerization when extensively vulcanized with sulfur. Apparently, ring formation and concurrent production of conjugated double bonds also occur, but there is only a very slight amount of double-bond shifting in polybutadiene. (auth)

23539 A CHROMATOGRAPHIC APPROACH TO THE DETERMINATION OF SULFATE ADSORPTION AND EXCHANGE OF LESS-RETENTIVE SOILS. S. C. Fang, R. D. Nance, Tsun Tien Chao, and M. E. Harward (Oregon Agricultural Experiment Station, Corvallis). Soil Sci., 14-18 (July 1961).

A chromatographic method was employed for studying sulfate adsorption and exchange on 12 less-retentive soils. Adsorption of sulfate by soils from dilute solutions showed good agreement with the Freundlich isotherm. The equilibrium coefficient (soil-SO_4/solution-SO_4) is rather constant for each of these less-retentive soils. A nearly complete exchange of the adsorbed $S35O_4$ was found in most soils, and rate of exchange varied with soil type. In a few soils the amount of nonexchangeable (difficulty exchangeable) sulfate increased when the soils were equilibrated with a higher sulfate concentration. The data also indicated that in four soils there were two sites of sulfate adsorption or exchange, and in the other eight only one site. Adsorption at site a is in kinetic equilibrium with that at site b. (auth)

23540 MEZHDUNARODNYI SIMPOZIUM PO MAKROMOLEKULAYRNOI KHIMII, SSSR, MOSKVA, IYUN 14-18, 1960. (International Symposium on Macromolecular Chemistry, Moscow, June 14-18, 1960). Moscow, Izd-vo AN SSSR, 1960. 469p.

Papers are included which were presented at the International Symposium on Macromolecular Chemistry in Moscow. Separate abstracts were prepared for six papers dealing with radiation effects on polymers and radioinduced polymerization. (D.L.C.)

23541 RADIATION COPOLYMERIZATION OF ACRYLONITRILE WITH POLYSTYRENE AND PERCHLOROVINYL. Kh. U. Usmanov, U. N. Musaev, and R. S. Tillaev. p.170-6 of "Mezhdunarodnyi Simpozium po Makromolekulayrnoi Khimii, SSSR, Moskva, 1960." Moscow, Izd-vo AN SSSR, 1960.

Swollen polystyrene film in acrylonitrile was subjected to Co^{60} radiation of 10^6 to 4×10^6 r. The resulting product was separated from the homopolymer by extraction. The percentage of grafting over the range studied increased with increasing radiation dose. The second part of the investigation was related to the graft polymerization of preliminary irradiated perchlorovinyl and acrylonitrile. The properties of the new polymers are discussed. (O.I.D.)

23542 THE ROLE OF THE SOURCE OF FREE RADICALS ON CROSS-LINKING OF THE POLYETHYLENES. R. Rado and M. Lazár. p.280-8 of "Mezhdunarodnyi Simpozium po Makromolekulayrnoi Khimii, SSSR, 1960." Moscow, Izd-vo AN SSSR, 1960.

When radiation is employed in the crosslinking of polyethylene, the excited molecules dissociate after energy absorption, hydrogen is evolved and radicals from the polymer form the crosslinkages. The hydrogen atom eliminated is quite mobile and easily removes other atoms from the polymer. Thus, during a single primary act, two polymer radicals or one crosslinkage and one hydrogen molecule are formed. The number of crosslinkages as well as the amount of hydrogen produced are proportional to the absorbed radiation dose. (O.I.D.)

23543 ON THE TRANSFORMATION OF CARBOXYL-CONTAINING BUTADIENE–STYRENE RUBBERS AND THEIR MIXTURES WITH E-CAPROLACTAM UNDER THE ACTION OF γ-RADIATION. I. Mladenov, I. A. Tutroskiĭ, and B. A. Dogadkin. p.293-301 of "Mezhdunarodnyi Simpozium po Makromolekulayrnoi Khimii, SSSR, Moskva, 1960." Moscow, Izd-vo AN SSSR, 1960.

Samples of carboxylated styrene rubbers containing varying amounts of styrene and methacrylic acid were exposed to γ radiation from a Co^{60} source (dose 0.1 to 50 mr). A decrease in the number of carboxyl groups, especially at low doses, was noticed. The radiochemical yield of crosslinked polymers is a linear function of the number of carboxyl groups in the initial polymer. Irradiation of carboxylated rubber in a mixture of e-caprolactam gives rise to addition of the latter to the rubber to form insoluble compounds. (O.I.D.)

23544 MODIFICATION OF THE PROPERTIES OF CELLULOSE BY GRAFTING. Kh. U. Usmanov, B. I. Aykhodzhaev, and U. Azizov. p.344-51 of "Mezhdunarodnyi Simpozium po Makromolekulayrnoi Khimii, SSSR, Moskva, 1960." Moscow, Izd-vo AN SSSR, 1960.

Chemical methods and γ rays from a Co^{60} source were used to study the graft copolymerization of cotton cellulose. Acrylonitrile and styrene were used as monomers. A wide range of radiation doses and monomer concentrations were investigated. The optimal dose for synthesis was 10^6 r. Separate irradiation of cellulose with subsequent treatment with the monomer did not lead to the formation of graft copolymers. (O.I.D.)

23545 THE CARBONIUM AND CARBANIONIC MECHANISMS OF γ-RAY-INDUCED POLYMERIZATION. A. D. Abkin. p.410-19 of "Mezhdunarodnyi Simpozium po Makromolekulayrnoi Khimii, SSSR, 1960." Moscow, Izd-vo AN SSSR, 1960.

Studies on the radiation polymerization of isobutylene, styrene, and other monomers led to the conclusion that at low temperatures a cationic mechanism underlies the polymerization process. Evidence of an anionic as well as a cationic mechanism was obtained on polymerization with γ rays, and it was found that the type of mechanism prevailing could be determined from the chemical structure of the monomer as well as the medium in which the reaction occurred. The processes are discussed for various monomers and under varying conditions. (O.I.D.)

23546 THE MECHANISM OF THE PROTECTIVE ACTION OF BENZENE RINGS DURING THE RADIOLYSIS OF POLYSTYRENE. A. N. Pravednikov and Wen-k'ang Ying. p.433-9 of "Mezhdunarodnyi Simpozium po Makromolekulayrnoi Khimii, SSSR, 1960." Moscow, Izd-vo AN SSSR, 1960.

An explanation is attempted for the apparent radiation stability of polystyrene. The crosslinking energy in the radiolysis of polystyrene is 100 times that of polyethylene, whereas the free radical yield in the radiation of linear paraffins is only 5 to 6 times that from alkylaromatic compounds. The mechanism of the reactions taking place was examined, and the radiolysis of deuterated toluene $C_6H_5CD_3$ was studied for experimental verification. It was assumed that the high radiation stability of polystyrene was to a considerable extent associated with disproportions of primary and cyclohexadienyl radicals. (OID)

23547 RADIOISOTOPES IN THE PHYSICAL SCIENCES AND INDUSTRY. VOL. III. Proceedings of the Conference on the Use of Radioisotopes in the Physical Sciences and Industry held at Copenhagen, 6-17 September 1960. (International Atomic Energy Agency, Vienna). Proceedings Series. Mar. 1962. 648p. (STI/PUB/20(Vol.III)). $8.00 (IAEA)

Fifty-one papers are included which treat preparation of labeled compounds and the use of radioisotopes in organic and physical chemistry. Separate abstracts were prepared for 48 of the papers. The remaining three papers were previously abstracted in NSA. (D.L.C.)

23548 LABELLING OF ORGANIC COMPOUNDS BY ELECTRIC DISCHARGE IN TRITIUM GAS. K. E. Wilzbach and L. M. Dorfman (Argonne National Lab., Ill.). p.3-11 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The gas exposure technique for tritium labelling has been used successfully for many organic compounds and has received wide acceptance. The use of this technique is somewhat restricted, however, since curie amounts of tritium and exposure times of several days are needed to supply sufficient energy to introduce even a small fraction of the gas into the compound. It has now been found that the use of an electrical discharge to promote ionization and excitation of the gas permits use of smaller quantities of tritium and shorter exposure times. In the new technique, a small amount, about 0.5 g, of the compound to be labelled is placed in the lower cup-shaped electrode of a glass vessel, and tritium gas is admitted to a pressure of 5 to 15 mm. The lower electrode is grounded and the upper electrode connected to a Tesla-coil leak-tester. A discharge at approximately 100 μa and 1000 v is passed through the gas for a few minutes. As in the gas exposure technique, some decomposition occurs and the compound must be purified from tritiated by-products. Activities in the range of 3 to 20 mc/g, comparable to those produced by simple exposure to tritium gas, have been obtained with several organic compounds. A particularly attractive feature of this technique is the possibility of using it in laboratories not equipped to handle the larger amounts of tritium required by the gas-exposure method. (auth)

23549 THE SYNTHESIS OF TRITIUM-LABELLED CYCLIC HYDROCARBONS BY USING TRITIUM RECOIL NUCLEI. A. N. Nesmeyanov, B. G. Dzantiev, et al. p.13-25 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

Results are given of an investigation of the interaction of tritium recoil atoms produced by the reaction $Li^6(n,\alpha)T$ with cyclohexane, cyclohexene, cyclohexadiene, methyl cyclohexane, cyclohexanol, cyclohexylammine, and benzene. Mixtures of these compounds with lithium carbonate were neutron-irradiated. From 1 g of lithium, 4 mc/hr of tritium was obtained with a 4×10^{12} n/cm^2 sec neutron flux. The total yield of the products depends on the amount of tritium yielded by the crystals, and, so, on the irradiation conditions. The yield from the separate components is determined by analysis. The irradiation products were analyzed by vacuum distillation, using carriers and gas-liquid chromatography. The results obtained show that 20 to 40% of the tritium yielded by the lithium carbonate crystals is embedded in the parent molecule of the irradiated compound. When, for instance, cyclohexene is irradiated together with 22% of the labelled parent compound, 16% cyclohexane, 4% methyl cyclopentane, and small amounts of other products are obtained. The specific activity of cyclohexane and methyl cyclopentane separated on a chromatographic column may be high, and the only dilution is with products of radiolysis. When other compounds are irradiated, there is a good yield only from the irradiated parent compound, and a small yield from other products. For purposes of preparation, cyclohexane and methyl cyclopentane are best obtained by irradiating cyclohexane; other cyclic hydrocarbons can be obtained by irradiating the compounds directly with lithium salts. A preparation column is described for separating tritium-labelled cyclohexane, cyclohexene and methyl cyclopentane from irradiated cyclohexene and for separating the products yielded by the reaction of tritium recoil atoms with other cyclic hydrocarbons. (auth)

23550 METHOD OF OBTAINING SULPHUR-LABELLED COMPOUNDS BY REACTION OF "HOT" SULPHUR-35 ATOMS WITH CYCLIC HYDROCARBONS. B. G. Dzantiev and I. M. Barkalov. p.27-41 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

Methods of obtaining sulfur-labelled compounds, such as aliphatic and cyclic mercaptans and sulphides, by direct synthesis employing recoil atoms from the reaction $Cl^{35}(n,p)S^{35}$ are discussed. Hot S^{35} atoms were obtained in the middle of the target substance by exposing mixtures of CCl_4 and a cyclic hydrocarbon (cyclopentane, cyclohexane) to neutrons in a reactor. A method is given for irradiating the mixtures and then separating the various sulfur-bearing compounds by specific chemical methods, rectification, and paper and gas-liquid chromatography. The purpose of the exchange is clarified. The relation of the yield of the separated sulfur-labelled products to the composition of the mixture and type of exposure was investigated, and an active-sulfur balance settled. New types of atomic sulfur reactions were established: the CH_2-group is replaced and implanted on the C-C link. The cyclic molecule is destroyed in the interaction with the hot sulfur atoms. Hot sulfur atoms can initiate the formation of polymers containing sulfur. The yields of these reactions were estab-

lished. Up to 98% of the active sulfur is linked in the form of organic sulfur compounds. It was shown that sulfur-labelled thiophene, tetrahydrothiopyrane, cyclopentyl-mercaptan, cyclohexylmercaptan, ethyl-propyl-butyl-mercaptans, dicyclopentylsulfide, polymeric mercaptans, and sulfides could be synthesized by heat. It is possible to regulate within broad limits the yield of various labelled compounds by changing the decelerating properties of the medium. (auth)

23551 EXTENSIONS OF THE TECHNIQUES FOR THE ACCELERATED UNSPECIFIC ISOTOPIC LABELLING OF ORGANIC COMPOUNDS. N. A. Ghanem (National Research Center, Cairo) and T. Westermark. p.43-67 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

A review is given of new means of obtaining acceleration in the reaction of a radioactive gas with a target material to be labelled, and examples of successful cases are given. The techniques include the use of microwave and radio-wave discharges, glow discharges affected through d-c or a-c sources, and ultraviolet radiation. Specific activities of more than 100 mc/g in purified significant quantities of products were obtained. Periods of exposure to discharge were of the order of one minute and decomposition was limited in most cases. Calculations of utilization of the energy absorbed during the labelling process were compared with the energy from ionizing radiation used by Wilzbach and others, and G values for isotope replacement are given. In polystyrene labelling, evidence is found that the mechanisms is governed by an atom-molecule reaction. (auth)

23552 PRODUCTION OF C^{14}-LABELLED COMPOUNDS FROM $C^{14}O_2$ ACCELERATED IN AN ELECTRIC FIELD—PHYSICO-CHEMICAL ANALYSIS OF SOME RADIOACTIVE COMPOUNDS OBTAINED. M. Guillaume (Université, Liège). p.69-72 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In French)

A method of labelling is described which is based on the acceleration by an electric field of $C^{14}O_2$, which can then react with an organic target in its path. The discharge cell described operates at 500 v, 150 μa, and the organic products to be labelled are exposed to this field for about three hours with CO_2 having a specific activity of 24 mc/mmole. The maximum yield remains low (about 6%), and 60% of the $C^{14}O_2$ is destroyed. This maximum activity is obtained only for aliphatic chains (50 μc/g for glutaric acid) or for aromatic substances with an aliphatic chain (acetyl-salicylic acid). (auth)

23553 PREPARATION OF VERY SMALL AMOUNTS OF TRITIUM-LABELLED POLYPHENOLS AND THE ISOLATION OF THE TRITIATED COMPOUNDS BY "NORMAL FREEZING." H. Schildknecht and F. Schlegelmilch (Universität, Erlangen, Ger.). p.73-82 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

0.01 mg to 0.1 mg resorcinol were labelled by an exchange reaction with tritiated water (5 c/ml) in alkaline medium and in the presence of a platinum oxide catalyst. In addition to the desired exchange, destruction of the organic substance occurred. Better results were obtained without a platinum-oxide catalyst and with a longer reaction time (10 hr) and still better at an increased temperature, up to 100°C. The separation of these small quantities of radioactive compounds from the tritiated water was made without loss by "Normal Freezing". A reaction tube with the solution which was to be concentrated, was lowered slowly into a copper tube cooled by a freezing mixture. During this procedure the liquid above the ice was stirred vigorously. The crystallization rate was 6 cm/hr and the cooling mixture had a temperature between −40 and −50°C. For isolating the labelled compounds, a very small part of the frozen solution on the top of the ingot was melted and repipetted onto a paper chromatogram. This was developed with a mixture of benzene–butanol–water. The spots on the paper chromatogram were located quantitively either by a technique of "scintillation autoradiography" or by scanning with a flow counter. The maximum specific activity of the purified samples was approx. 17 μc/mg. (auth)

23554 THE SYNTHESIS OF THE INSECTICIDES ALDRIN AND DIELDRIN LABELLED WITH CARBON-14 AT HIGH SPECIFIC ACTIVITY. Daniel J. Thomas and A. Edward Kilner (Radiochemical Centre, Amersham, Bucks, Eng.). p.83-90 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Acetylene-1,2-C^{14} is converted successively to tetrachloroethane and trichloroethylene, and this is condensed with carbon tetrachloride by the Prins reaction in the presence of aluminium chloride to octachlorocyclopentene. Dechlorination gives hexachlorocyclopentadiene which undergoes a Diels-Alder addition to bicyclo(2, 2, 1) hepta-2,5-diene to give aldrin-C^{14} in 12% yield from barium carbonate. Oxidation of Aldrin gives the 6,7 epoxide, Dieldrin, in 87% yield. An account is given of the separation of octachlorocyclopentene from the crude product of the Prins reaction by gas-liquid chromatography and of the separation of Aldrin and Dieldrin on a small preparative scale by reversed-phase paper chromatography. (auth)

23555 PREPARATION OF C^{14}-LABELLED TETRAZOLIUM SALTS AND TRACER STUDY OF THE TETRAZENE–FORMAZAN REARRANGEMENT. Joseph Márton (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest), Julia Meisel, and Thomas Gosztonyi. p.91-6 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The preparation of [5-C^{14}]-TTC, [5, 5'-di-C^{14}]NT (neotetrazolium) and [5, 5'-di-C^{14}]-BT (tetrazolium blue) starting from benzaldehyde-[1-C^{14}] was accomplished. The yields for both mono- and ditetrazolium salts are high, and the products can be obtained with high specific activity. The purity of the samples was investigated by paper chromatography. A method was developed to prepare C^{14} labelled ditetrazolium salts of high purity. The formation of the formazan, the precursor of the tetrazolium salt, goes through an unstable intermediate of tetrazene-type structure which rearranges rapidly in basic medium, to yield the formazan. The tetrazene intermediate can be isolated under suitable conditions. By using C^{14}-labelled benzaldehyde phenylhydrazone, this rearrangement was investigated and a verification of its intramolecular character given. (auth)

23556 SYNTHESIS OF METHYL 3-O-α-d-GLUCOPYRANOSYL-C_6^{14}-β-d-XYLOPYRANOSIDE AND METHYL 2-O-α-d-GLUCOPYRANOSYL-C_6^{14}-l-NOVIOPYRANSODIE. S. A. Barker, M. C. Keith, M. Stacey, and D. B. E. Stroud (Univ. of Birmingham, Eng.). p.97-102 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Where difficulty is encountered in the chemical synthesis of a disaccharide glycoside labelled with C_6^{14} specifically in only one of its sugar moieties it is often convenient to re-

sort to a synthesis catalyzed by microbial transglycosylases. Two examples of the application of this technique are reported; the syntheses: Maltose-C_6^{14} + Methyl β-d-xylopyranoside (Penicillium lilacinium/transglucosylase) → Methyl 3-O-α-d-Glucopyranosyl-C_6^{14}-β-d-xylopyranoside (I) + Glucose-C_6^{14} Maltose-C_{12}^{14} + Methyl *l*-noviopyranoside (Fusarium moniliforme/transglucosylase) Methyl-2-O-α-d-Glucopyranosyl-C_6^{14}-*l*-noviopyranoside (II) + Glucose-C_6^{14}. In such syntheses, it is predictable that the anomeric character of the glycosidic linkage of the donor disaccharide will be retained in the disaccharide synthesized and that the glycosyl residue transferred will be attached, through its reducing group, to the receptor monosaccharide glycoside. By using either a C^{14}-labelled donor disaccharide or a C^{14}-labelled receptor glycoside, a disaccharide can be synthesized with only one of its sugar moieties labelled. In the synthesis of II the only hydroxyl group free in the receptor methyl novioside is on C_2 and the transferred glucosyl residue can only be attached here. In the synthesis of I the methyl xyloside has free hydroxyls on C_2, C_3, and C_4 and the microbial enzyme was found to transfer the glucosyl residue specifically to the hydroxyl on C_3. The structures of I and II were established by the results of elemental analysis, optical rotation, infrared spectra together with an examination of the products of acid hydrolysis and periodate oxidation. (auth)

23557 A GENERAL METHOD OF PREPARING C^{14}-LABELED ISOCYANATES. TRACER STUDY OF THE DIMERIZATION OF ISOCYANATES. L. Oetvoes, J. Márton, and J. Meisel (Central Research Inst. for Chemistry, Hungarian Academy of Sciences, Budapest). p.103-9 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The tendency of isocyanates to dimerize in the presence of suitable catalysts and the thermal dissociation of the formed dimers has long been known. Recently an exchange equilibrium between isocyanates and isothiocyanates has been reported. It has been assumed that this exchange also takes place through the formation of a dimer. The investigation of this exchange reaction with C^{14} as a tracer was performed in order to establish the preparative usefulness of the reaction and to study its mechanism. For this purpose phenyl-isocyanate-carbonyl-C^{14} was prepared by the Curtius reaction, on a semi-micro scale. The compound was equilibrated with inactive aryl isothiocyanates and alkyl isocyanates, respectively, after which a C^{14}-labelled species of the originally inactive compound was isolated. The results showed that under suitable conditions this exchange reaction can be generally applied for preparing both C^{14}-labelled isocyanates and C^{14}-labelled isothiocyanates. A method for the preparation of labelled isocyanates with a good yield was developed. A study of the mechanism of the reaction both in the presence of and in the absence of catalysts gives evidence for the exchange of carbonyl groups between isocyanates in both cases. Therefore the intermediate dimer must possess the structure of 1,3-diaryl-1,3-diaza-cyclobutane-2,4-di-on, suggested previously on the basis of crystallographic data. It is also shown that a series of another type of intermediates might occur during dimerization and dissociation; a general scheme is proposed for the mechanism of this reaction, involving possible intermediates, side reactions, and products. (auth)

23558 STUDY OF CARBON-ISOTOPE EXCHANGE REACTIONS BETWEEN POTASSIUM CYANIDE AND SOME CARBONATES, AND THEIR USE FOR OBTAINING C^{14}-LABELLED POTASSIUM CYANIDE. O. I. Andreeva and G. I. Kostikova. p.111-22 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

Results are presented of a study on the isotope exchange of potassium cyanide with compounds differing greatly from it both in composition and structure, such as carbonates of alkaline and alkali-earth metals. The carbon-isotope exchange reaction in the $KC^{12}N$-$BaC^{14}O_3$ system was studied at 600 to 800°C. The ratio between the components of this system and those given below agreed with the equimolecular ratio. It is shown that at high temperatures complete exchange between these compounds can be secured. The exchange reaction begins when the cyanide melt is formed; later it occurs between the liquid and the solid phases, and its speed increases with temperature; at 800°C it is completed in 2 hr. With carbonates of alkali metals the exchange reaction occurs in the melt and is completed at lower temperatures. Cyanide-labelled potassium was obtained by the following method: (1) The isotope exchange reaction $KC^{12}N$-$BaC^{14}O_3$ is produced at 800°C in 2 hr. (2) The mixture KCN + $BaCO_3$ is separated by extracting the KCN with liquid ammonia in a circulating extractor. By exchanging the equimolecular quantities KCN and $BaCO_3$, potassium cyanide is obtained with a chemical yield of more than 90% and a basic-substance content of 96 to 97%. By using $BaCO_3$ with a high specific activity (60 to 70 mc/g), a KCN specific activity of over 80 mc/g may be obtained. The barium carbonate depleted of isotope C^{14} regenerates after the ammonia extraction without appreciable loss. (auth)

23559 SPECIAL SYNTHESIS OF CERTAIN IODIZED ORGANIC COMPOUNDS. R. Henry, D. Debuchy, and E. Junod (Centre d'Études Nucléaires, Saclay, France). p.123-9 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In French)

The technological difficulties of working with radioactive products call for maximum simplicity in methods of chemical synthesis. For iodized compounds two special methods were selected: (a) Utilizing fission recoil, simple iodized compounds such as iodobenzene or methyl iodide were prepared with good yields and a good degree of purity. The method consisted in irradiating mixtures of uranium oxide and benzoic acid or ammonium acetate. The iodized product was separated by distillation after dissolution of the recoil medium in a solvent. (b) By isotopic exchange between mineral iodine with different valencies and complex molecules such as rose bengal and diodone, satisfactory labelling yields were also obtained. These reactions were arranged so as to reduce the isotopic-exchange time to the minimum. For rose bengal, a yield of 90% after several hours was obtained by exchange between NaI and the organic molecule in an aqueous medium and in the presence of oxygenated water. For diodone, the method proposed by Liebster was adapted to reduce losses during purification. A description of the methods of analysis chosen for these different compounds is given. (auth)

23560 A NEW METHOD FOR THE PREPARATION OF I^{131}-LABELLED p-IODO-BENZENESULPHONIC ACID ANHYDRIDE (PIPSAN). N. Hesselbjerg Christensen (Danish Atomic Energy Commission, Risø, Research Establishment, Roskilde, Denmark). p.131-8 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

I^{131}-labelled pipsan may be used, together with S^{35}-labelled pipsan, in a double-isotope-derivation technique for the analytical determination of various steroids. The

preparation of high-specific-activity I^{131}-pipsan involves serious health hazards due to the γ radiation of I^{131} and a shielded cell with remote-handling equipment has to be used. Earlier methods, in which I^{131} is introduced in diazobenzenesulfonic acid, involve many steps with purification of the intermediary products and necessitate rather complicated equipment. By the introduction of I^{131} in diazobenzene and by sulfonation of the labelled iodobenzene with oleum, labelled pipsan is obtained directly. This method has proved feasible for remote handling in a shielded cell. The procedure is based on recent Russian papers. Chemical aspects of the procedure are briefly discussed. Descriptions are given of some of the equipment used in the remote handling, e.g.: a micro steam-distillation apparatus for the preparation of iodobenzene, and a rotating Perspex pipetting station used for the addition of washing liquids, for air-propagation, and for removal of supernatants. (auth)

23561 A NEW METHOD FOR PREPARING CERTAIN SULPHURATED SUBSTANCES LABELLED WITH S^{35}. F. Chapeville, H. Maier-Huser, and P. Fromageot (Centre d'Etudes Nucleaires, Saclay, France). p.139-43 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In French)

Previous investigations have shown that the yolk-sac of embryonic birds' eggs can be used to produce the following reactions: (a) reduction of sulfate to sulfite; (b) fixation of the sulfite on the carbon chain produced by the desulfhydration of *l*-cysteine, with formation of *l*-cysteic acid; (c) decarboxylation of the *l*-cysteic acid into taurine. The enzymatic system which causes reaction (b) has been purified. It also acts as a catalyst in the sulfur exchange between the cysteine and the mineral sulfide. These data were used in preparing sulfurated substances labelled with S^{35}: taurine-S^{35}, *l*-cysteine-S^{35}, and *l*-cysteic acid-S^{35}. For each of the three, the chemical reactions involved, the methods of preparation, the experimental conditions of extraction, and purity control are discussed, together with the yields and specific activities obtained. (auth)

23562 SOME SYMMETRICAL HALOGEN AND METHOXY EXCHANGE REACTIONS IN AROMATIC SYSTEMS. R. W. C. Broadbank, A. H. E. Harhash, and S. Kanchanalai (Leicester Coll. of Tech. and Commerce, Eng.). p.179-86 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The iodine exchange between iodo-nitro-aromatic compounds and iodide ions in acetone or methanol solution was studied both qualitatively and quantitatively by labelling the iodide ions with iodine-131. The reaction mixture is sampled at convenient time intervals, the two reactants separated by toluene-water extraction, and the progress of the reaction ascertained by beta-counting with a liquid Geiger counter. Measurements were extended to "carrier-free" concentrations of iodide ions. The preparation of certain nitro-methoxy-aromatic compounds, labelled with carbon-14 in the methoxy group, is described. Symmetrical methoxy exchange reactions of these compounds with methoxide ions, in methanol solution, was studied. After separation of the reactants (from samples of the reaction mixture taken at convenient time intervals) by toluene-water extraction, the aromatic compounds are recovered and their specific activities determined by beta scintillation counting with a plastic phosphor. In the discussion of the experimental data, special attention is paid to the effect of ionic strength on the specific rate of the reaction. Comparison is made with ionic strength effects observed in symmetrical biomolecular nucleophilic reactions at a saturated (aliphatic) carbon atom, and reference is made to certain other aromatic nucleophilic substitution reactions. (auth)

23563 PRELIMINARY EXPERIMENTS ON THE USE OF RADIOACTIVE INDICATORS IN MACROMOLECULAR CHEMISTRY. L. de Brouckère, R. van Leemput, and R. Stein (Université Libre, Brussels). p.187-94 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

In studies of osmotic phenomena with high polymers, two causes of error are particularly important: (a) Diffusion of low-molecular-weight polymers across the membrane; (b) Polymer adsorption on the membrane. For investigations on both phenomena, radiotracer methods present decisive advantages over the classical and far less sensitive gravimetric procedures. The polymer used in the experiments was a hetero-disperse sample of (poly) chloro-butyl acrylate which was ionically chlorinated with Cl^{36} starting from a sample of (poly)butyl acrylate. This polymer was dissolved in acetone. Diffusion chambers similar to twin-cell osmometers were set up. Cellophane membranes with permeabilities of 6.7×10^{-5} to 30.6×10^{-5} hr^{-1} separated the solution from the solvent. It was found that: (a) With the apparatus, about two hundred hours were necessary to reach an equilibrium or steady state in diffusion experiments; (b) the fraction of polymer diffusing through the membrane in a given time was independent of the concentration; (c) the amount of polymer diffusing was related to the permeability of the membrane; and (d) a practically irreversible adsorption of polymer on the membrane was observed (30 to 40 $\mu g/cm^2$). (auth)

23564 STEREOCHEMISTRY AND RADIOCHEMISTRY OF DEAMINATION REACTIONS. C. J. Collins and B. M. Benjamin (Oak Ridge National Lab., Tenn.). p.195-203 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The utility of the combined radiochemical-stereochemical technique in detecting which side of the migration terminus is attacked by each of two migrating groups during reactions involving 1,2 shifts has previously been demonstrated. These same techniques were applied to the mechanisms of the deaminations of (1) optically active threo- and erythro-1,2-diphenyl-1-amino-2-propanol, (2) optically active threo- and erythro-1-phenyl-2-p-tolyl-1-amino-2-propanol, and (3) optically active 1,1-diphenyl-2-aminopropane. Both stereospecific and non-stereospecific C^{14} labels were employed. In each case the optical isomers produced were isolated, and the fate of each label was determined. Appropriate control experiments were performed with reactants which were labelled both with C^{14} and with deuterium. The absolute configurations of reactants and products for each reaction were studied through synthetic sequences which do not affect the optical integrity of the asymmetric centers. From these data, it was possible to arrive at certain definite conclusions concerning the mechanisms of the foregoing reactions. For example: (1) the fractions of each reaction proceeding through cis- and trans-transition states were evaluated, and (2) new information was gained concerning the importance or unimportance of "neighboring group participation." Finally, although classical techniques were employed to clarify the stereochemistry of the families of compounds studied, a novel radiochemical method was also used for the same purpose. (auth)

23565 DEHYDROCYCLIZATION OF 2,2-DIMETHYL-4-(METHYL-C^{14})-PENTANE AND 3-(METHYL-C^{14})-HEPTANE OVER CHROMIA–ALUMINA. F. R. Cannings, A. Fisher, J. F. Ford, P. D. Holmes, and R. S. Smith (British Petroleum Co., Ltd., Sunbury-on-Thames, Middx, Eng.). p.205-16 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The relative specific activities of the products obtained by processing the above C^{14}-labelled hydrocarbons over a potassium and cerium-promoted chromia-alumina catalyst were measured. Products were separated by gas chromatographic techniques, burnt to carbon dioxide, and assayed as barium carbonate, using an end-window Geiger-Müller tube. The distribution of radioactivity between side chain and ring in the aromatic products was assessed by dealkylation over fluorinated alumina catalyst and the distribution between α and β carbon atoms of ethylbenzene, produced from methylheptane, by dealkylation to toluene and benzene over a nickel catalyst. The results obtained with the first compound are consistent with an over-all mechanism in which methyl groups at both ends of the molecule become attached at adjacent sites on the catalyst surface. Rearrangement at the trisubstituted end of the molecule to give a six-membered ring, followed by dehydrogenation, gives p-xylene with 50% activity in the methyl groups. Toluene produced during cyclization has an activity distribution indicating that rearrangement also occurs to a lesser extent at the other end of the molecule. The dehydrocyclization of methylheptane leads to the formation of the expected aromatics. However, the activity distribution shows that these have not arisen entirely by a simple ring-closure mechanism; a probable mechanism is the formation and subsequent rearrangement of C_5, C_6, and C_7 ring intermediates, tending to randomize the distribution of active carbon. The labelled hydrocarbons were prepared on a one-gram scale by a Grignard reaction using a novel decomposition step. (auth)

23566 ISOTOPIC DATA TO STUDY THE MECHANISM OF THE OXIDATION OF MERCAPTOACETIC ACID. D. Gál (Univ. of Szeged) and L. Guczi. p.217-24 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Numerous researchers have been studying the liquid-phase autoxidation by molecular oxygen of compounds containing a mercapto group. It has been stated that, in the course of the reaction, sulfide is formed, but the exact mechanism of this process has not been determined. The oxidation of mercaptoacetic acid, at 50°C and at a pH of S, was investigated both in the presence of Complexon IV and in the presence of iron ions. Na_2S, labelled with S^{35}, was introduced into the system and it was determined that this sulfide considerably increases the rate of the oxygen uptake both in the processes catalyzed by trivalent iron and free of iron ions. In the course of the reaction the concentration of the sulfide, its specific activity and its total activity were measured. In using these data and on the basis of the kinetic isotopic method developed by Neiman and coworkers, it was possible to calculate the rate of sulfide formation and its further oxidation. In comparing these data with other kinetic data, it is shown that the oxidation of mercaptoacetic acid in the liquid phase is a branching chain reaction, one of its principal chains being the formation of Na_2S and its further oxidation. Moreover, it was determined that sulfate is formed in the course of the reaction only through the inorganic sulfide. Iron ions catalyze the formation of organic disulfide and therefore also have influence on the sulfide formation. (auth)

23567 EVALUATION OF DEUTERIUM ISOTOPE EFFECTS IN PHOTOCHEMICAL REACTIONS OF FORMIC-d ACID BY USE OF C^{14}. G. A. Ropp (Oak Ridge National Lab., Tenn.). p.235-42 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The usefulness of measured values of primary and secondary deuterium kinetic-isotope-effect ratios in the study of organic reactions is well known. However, measurement of such ratios by direct methods is sometimes difficult. An indirect method which can be used to circumvent difficulties in some cases is illustrated by the determination of the primary deuterium isotope effects in the vapor-phase reactions between HCOOH + Cl_2 and HCOOH + Br_2 which under the influence of visible light give CO_2 and, respectively, 2 HCl and 2 HBr. For the evaluation of k_D/k_H, the ratio of specific rate constants for reaction of formic-d acid and formic acid, a 50 : 50 mixture of DCOOH and $HC^{14}OOH$ was added to enough chlorine (or bromine) to effect reaction of approximately 5% of the mixture of acids. The C^{14} dioxide produced was precipitated as barium carbonate-C^{14}, of which the specific activity (S_5) was then determined by radioassay of the gas released when a sample was acidified. The specific activity (S_{100}) of the barium carbonate-C^{14} representing 100% reaction of a portion of the 50 : 50 mixture of DCOOH and $HC^{14}OOH$ with excess chlorine was also determined. A simple equation was derived, making the reasonable assumption that the C^{14} isotope effects in the two reactions mentioned are negligibly small in comparison with the deuterium isotope effects. Using the equation, k_H/k_D values, 2.0 and 2.7, were calculated for reactions with Cl_2 and Br_2, respectively. An earlier study (Ropp, Danby, and Dominey, 1957) showed that reaction with Cl_2 was accompanied by a much smaller C^{13} kinetic isotope effect than the reaction with Br_2. This was taken as an indication that the carbon-hydrogen bond is stretched more in the transition state for the Br_2 reaction than for the Cl_2 reaction. The difference reported between the corresponding deuterium isotope effects is less pronounced, though in the same direction as the difference between the C^{13} effects. A reasonable conclusion is that bromine-hydrogen bonds formed in the transition state for the reaction with Br_2 largely compensate the stretching of the carbon-hydrogen bond. (auth)

23568 A STUDY OF THE MECHANISM OF CERTAIN HETEROGENEOUS CATALYTIC PROCESSES USING C^{14}-LABELLED COMPOUNDS. I. V. Isagulyants and A. A. Balandin. p.245-54 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

An investigation is made of the method of calculating individual phase velocities for parallel, consecutive, and parallel-consecutive reactions from kinetic data obtained by the use of labelled atoms. The method is used for calculating individual phase velocities in the decomposition reaction of isopropyl alcohol by vanadium trioxides, dehydrogenations of butane–butylene mixtures, and dehydrations of ethyl alcohol. Compounds containing C^{14} were used in this study. (auth)

23569 STUDY OF THE ISOTOPE EFFECT IN HYDROGEN EXCHANGE REACTIONS IN LIQUID HYDROGEN BROMIDE AND LIQUID AMMONIA. I. F. Tupitsyn, N. K. Semenova, and G. I. Avdulov. p.255-67 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

An investigation was made on the thermodynamic isotope effects in naphthalene–hydrogen bromide and benzene–ammonia systems in the presence of potassium amide act-

ing as a catalyst. Protium, deuterium, and tritium atoms were present in the system during the experiments. In the experiments on direct and "reverse" exchange, the kinetic isotope effects of hydrogen were measured in the liquid-phase systems hydrogen bromide–diphenyl and benzene–ammonia. The mechanisms of exchange reactions of aromatic hydrocarbons with hydrogen bromide and ammonia are considered with regard to the findings of kinetic experiments. There is a brief description of the methods of preparation in which deuterized and tritiated compounds are used. For tritium counting, a scintillation coincidence system was used, and spectroscopic and mass spectrometric methods were used for the isotopic analysis of deuterized substances. (auth)

23570 INVESTIGATIONS ON THE STRUCTURE OF COMPLEX COMPOUNDS BY RADIOISOTOPE EXCHANGE. THE STRUCTURE OF CYANONITROSYL COMPLEXES. B. Jeżowska-Trzebiatowska and J. Ziółkowski (Univ. of Wrocław, Poland). p.269-81 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The nitrosyl group as the complex ligand is of particular interest because of its structure as well as its ability to form NO^- or NO^+ groups. To study the electronic structure of $K_3Mn(CN)_6$ and $K_2Mn(CN)_5NO$, the valency of the metal, and the bonding type, investigations were carried out by applying the method of radioisotopic exchange, as well as other physico-chemical methods. It was found that by introducing the nitrosyl group into the hexacyanate ion, the stability of the complex is largely enhanced both in the solid state and in solution. This observation was confirmed by investigation of exchange kinetics in the systems (I) $K_3Mn(CN)_6 + KC^{14}N$ and (II) $K_2Mn(CN)_5NO + KC^{14}N$. In both cases, the exchange reactions are of first order, taken as a function of time, but differ considerably in their velocities, as well as in their activation energies. The anion $Mn(CN)_5NO^{-3}$ is sensitive to light, so that the exchange reaction is photochemical in character. The ratio of the exchange velocity constants in the dark and at standardized illumination is 1:100. The first exchange reaction (I) proceeds according to the association mechanism while the second one (II) possesses a composite association-dissociation mechanism. Analysis of the partition of activity within the cyanide groups undergoing exchange in the isotopic equilibrium state, revealed the identity of at least four cyanide groups. The high stability of the nitrosyl complex, as compared with the hexacyanate, was proved in various ways. All this pointed to a NO^- structure in the complex. Previous research has shown that the nitrosyl group is coordinated as NO^+. This suggests a resonance structure of the complex by assuming the resonance of an electronic pair between the T_{2g} shell of the central atom and the p shell of the nitrogen atom. (auth)

23571 ION EXCHANGE STUDIES OF ALPHA-HYDROXY CARBOXYLIC ACID–LANTHANIDE AND ACTINIDE SYSTEMS. G. R. Choppin (Florida State Univ., Tallahassee), D. Moy, and L. W. Holm. p.283-99 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Alpha-hydroxy carboxylic acids have been used extensively for the separation of lanthanide and actinide elements with cation exchange resins. Sorption of these elements in the same solutions occurs on strong base anion-exchange resins. A study was made by elution and equilibrium distribution techniques of the behavior at tracer-level concentrations of these anion-exchange systems. One objective was to measure the separation factors to assess anion exchange as a possible complement to cation exchange separation. Since very little attention was given to characterizing the complexed species present in these separation systems, a second objective was to attempt such characterization through interpretation of both cation and anion exchange data. Glycolic, lactic, and alpha-hydroxy isobutyric acids were used together with radioactive tracers of Ce, Pm, Eu, Tb, Tm, Y, Cm, and Cf. The elutions and equilibrium distributions were performed both at 25 and 87°C. In all three eluants, the separation factors were smaller for the anion exchange than for the analogous cation exchange. In the glycolate solutions, the separation factors were largest and the values of the distribution coefficient K_d indicated that these were the most stable complexes. The plots of log K_d against log anion concentration pass through a maximum and then approach a slope of -1, indicating the presence of an anionic complex MX_4^-. The existence of this negative complex in the solution phase was demonstrated by electromigration studies of Tm^{170} tracer in these solutions. At the solution concentration corresponding to the maximum K_d value, it can be shown that the predominant solution species is MX_3. Approximate successive stability constants were calculated for these systems and with these it is possible to construct diagrams showing the relative concentration of the species M^{+3}, MX^{+2}, MX_2^+, MX_3, and MX_4^- as a function of the concentration of X^-. (auth)

23572 THE RATES AND ORDERS OF ELECTRON EXCHANGE REACTIONS IN MIXED SOLVENTS USING TRACER TECHNIQUES. Edward S. Amis (Univ. of Arkansas, Fayetteville). p.301-14 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Very interesting results on the rate and mechanisms of the electron exchange reaction between U (IV) and U (VI) in hydrochloric acid solutions involving pure and mixed solvents were obtained using uranium-233 as a tracer. Ions, similar to the complex species postulated to explain the kinetics, were proved to exist spectrophotometrically, and similar ions were postulated to explain transference data in the case of uranyl chloride. The stability as a function of the solvent composition of the UO_2X^+ type of ion was found to be parallel, in a remarkable way, with the logarithm of the specific velocity constant of the electron exchange reaction as a function of the solvent composition in the water–ethanol solvent system. If the data on ion complex stability to the kinetic situation are extrapolated, it would appear that the effect of the solvent on the stability of the UO_2X^+ complex is a principal factor in the influence of the solvent on the rate of the electron exchange reaction between U (IV) and U (VI) ions. (auth)

23573 CONTRIBUTIONS TO THE SOLVENT EFFECT IN ISOTOPE EXCHANGE REACTION. E. Koeroes, E. Schulek, and L. Pataki (L. Eötvös Univ., Budapest). p.315-24 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The effect of solvent on the exchange rate and the possible ways of accelerating the studied exchange reaction, at constant temperature and concentration, was investigated. The exchange of iodine atoms between 1-phenyl-2,3-dimethyl-4-iodopyrazolone (4-iodo-antipyrine) and elementary iodine was chosen as a model reaction. First, the effect of the dielectric constant (ϵ) was examined and it appears that the rate of exchange is affected not solely by ϵ. The structure of the solvent and the micro-conditions prevailing in the single spatial particles of the solvents also play an important role. The rate of exchange was also

studied in a homologous series. In addition, the effect of water content of the solvents was examined. The results show that there is a possibility of measuring the concentration of solvents, which encourage a quick exchange, in solvents where the exchange is slow. Exchange was also studied in aromatic solvents and the rate is markedly increased by electrophilic substituents. Further, the exchange reaction was carried out in the presence of compounds which promote the heterolytic dissociation of iodine (such as $HgCl_2$, $AgNO_3$). The important role of I^+ ions in the exchange reaction is clearly shown by the experiments. Also, the possibility of demonstrating the intermediate formation of I^+ ion in certain chemical reactions is pointed out. (auth)

23574 TRACER INVESTIGATIONS OF THE FATE OF SULPHUR ATOMS IN THE COURSE OF HIGH-TEMPERATURE REACTIONS. A. H. W. Aten, Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam). p.325-36 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The fact that sulfur occurs in many different chemical conditions suggests a number of interesting problems in connection with the movement of the sulfur atoms in the course of reactions between different compounds of this element. Quite an amount of information is available concerning reactions between compounds of sulfur in solution and, in general, the different sulfur fractions do not mix under these conditions. An entirely different situation is found in reactions between gases and solid compounds. For these processes much higher temperatures are, in general, required and at these higher temperatures the sulfur atoms in the different fractions tend to mix to a very large extent. This behavior is illustrated by means of data obtained on the exchange of radiosulfur between sulfur vapor and sulfur dioxide, between sulfur dioxide and solid sulfite, and between sulfur dioxide and solid sulfate. The same behavior was observed in the chemical decomposition of thiosulfate, labelled in one of the two sulfur fractions and in the oxidation of this compound. Finally, it is shown that mixing is also very strong in the reaction between sulfur vapor and solid sulfate. (auth)

23575 PRINCIPLES AND APPLICATIONS OF HETEROGENEOUS ISOTOPIC AND NON-ISOTOPIC ION EXCHANGE ON THE SURFACE OF IONIC CRYSTALS. K. H. Lieser and W. Hild (Technische Hochschule, Darmstadt, Ger.). p.337-49 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Ionic crystals which are in contact with an electrolytic solution exchange isotopic and non-isotopic ions on their surfaces. These processes are treated quantitatively and measured as a function of time. In general, two different processes are observed: exchange with the surface ions and recrystallization of the ionic crystals in the solution. During ion exchange, recrystallization is only observed if mixed crystals are formed. The rate of the ion exchange on the surface is determined by the surface reaction, not by diffusion in the solution. The following systems are discussed as examples of isotopic and non-isotopic ion exchange reactions: $Sr^{90++}/SrSO_4$, $Sr^{90++}/CaSO_4 \cdot 2H_2O$, $Sr^{90++}/BaSO_4$. These investigations are important for the separation of carrier-free nuclides from aqueous solutions. One practical application is the separation of Sr^{90} on "barium sulfate columns." (auth)

23576 USE OF CARBON-14 FOR THE STUDY OF ELEMENTARY CARBON EXCHANGE BETWEEN METHANE AND ITS CHEMISORPTION RESIDUES ON METALLIC FILMS. R. Coekelbergs, J. Decot, A. Frennet, and G. Liénard (Ecole Royale Militaire, Brussels). p.351-60 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In French)

After giving the results of the most recent work done with a view to providing a rational account of the exchanges between two gases in contact with a catalyst, the authors, using C^{14}, proceed to study elementary exchange between methane and its chemisorption residues on molybdenum films. The surface is labelled in two ways: by chemisorption of $C^{14}H_4$ at different temperatures, or by exchange between $C^{14}H_4$ with a high specific activity and a metallic film previously treated with inactive methane. The C^{14} is counted in the form of CO_2 in the Geiger region. The results show that the exchange rate is measurable from about 100°C onwards and that it reaches a maximum at about 250°C. Furthermore, the exchange is governed by laws which vary according to the prior treatment of the surface. On the basis of the results discussed, a methane displacement pattern is suggested which is compared with the CH_4 and D_2 exchange mechanisms suggested by Kemball. (auth)

23577 EXPERIMENTAL COMPARISON OF PRIMARY AND SECONDARY ISOTOPE EFFECTS IN TRITIUM OR CARBON LABELLED COMPOUNDS. H. Simon and D. Palm (Technische Hochschule, Munich). p.361-7 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The isotope effects (IE) in the phenylhydrazone formation of β-naphthaldehyde-(carbonyl-T), β-naphthaldehyde-(carbonyl-C^{14}), 3-phenylpropionaldehyde-1-T, β-d-mannose-1-C^{14}, and β-d-mannose-1-T were determined. The IE in the formation of mannose-(1-C^{14})-phenylhydrazone depends on whether the reaction is carried out immediately after the mannose has dissolved or after complete mutarotation. In this reaction, the IE in β-naphthaldehyde-C^{14} gives an expected value of 1.06, whereas the tritium-labelled compound has an inverse IE of about 0.78. With the 3-phenylpropionaldehyde (carbonyl-T), the IE is 1.1. Though the IE of both tritium-labelled compounds are different in direction, the frequency shift of the carbonyl group in the infrared spectrum of the corresponding deuterium-labelled compounds shows the same direction and magnitude. Therefore, the direction of the secondary IE cannot be predicted from the frequency shift of the reacting groups which is caused by the influence of α-substituted hydrogen isotopes. (auth)

23578 REDUCTION OF PROMETHIUM ON A MERCURY CATHODE. A. K. Lavrukhina, G. M. Kolesov, and Hsiao-en T'ang. p.369-78 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

The separation of radioactive promethium on a mercury cathode with samarium was observed, which showed that it can be reduced to a bivalent state. Using radiochemically pure Pm^{147}, a detailed study was made of the influence of a series of factors on the extent to which promethium passes into an amalgam. It was shown that radioactive promethium only passes into the mercury cathode if the current is relatively dense (above 50 ma/cm^2) and when rare-earth elements such as ytterbium and samarium, which have a stable bivalent state, are present in the electrolyte. Electrolytic separation of the promethium is not observable until formation of the mixed potassium and samarium amalgam. The promethium then passes into the amalgam up to

85%. When the current is denser (100 ma/cm^2), a notable difference may be observed in the transition speed of the promethium and samarium. The promethium separation is mainly affected by the nature of the alkali metal contained in the electrolyte. With lithium, the degree of promethium transition does not depend on the presence of another rare-earth element or the citrate ion concentration. This confirms the occurrence of electrolytic reduction of promethium in electrolysis with a mercury cathode at high current densities. Separation of the promethium into the mercury cathode goes through the stage of its reduction to a bivalent state with formation of the amalgam with the alkali metal. The behavior of cerium and erbium was also studied. From the results of this study and all the published data, it is concluded that promethium and other elements of the cerium group can be reduced to a bivalent state under certain conditions of electrolysis. (auth)

23579 THE ADSORPTION OF HYDROGEN ON A MOLECULAR SIEVE AT −196°C AND THE OBSERVATION OF AN ISOTOPE EFFECT. W. G. Duncombe (Wellcome Research Labs., Beckenham, Kent, Eng.). p.379-85 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Linde Molecular Sieve 4A was examined as a possible means of handling small volumes of hydrogen isotopes in a vacuum system, as an alternative to the slow Toepler pump method. The equilibrium pressure was measured for various volumes of hydrogen adsorbed by 1 g of Sieve at −196°C. Experiments with activated charcoal showed the superiority of the Sieve as a hydrogen adsorbent. 1 g of the Sieve in a system of vol. 500 ml will adsorb about 97% of a 1-ml sample of hydrogen. Adsorption is negligible at −78°C and desorption is quantitative and rapid at room temperature. The possibility of an isotope effect was investigated by adsorbing measured volumes of tritium (5 μc/mole) at an equilibrium pressure of about 5 mm, pumping off the system for times up to 15 min, and measuring the volume of residual hydrogen. The latter was converted quantitatively to water, thence to butane, and gas-counted. The specific activity was always higher than that of tritium which had undergone 10 cycles of adsorption and desorption without intermediate pumping off, so that there was no net loss of gas. This had the same specific activity as untreated tritium from the storage bulb. It was found that log (residual vol./initial vol.) was proportional to 1/log (residual sp. act./initial sp. act.) over the range investigated (0 to 90% of initial gas pumped off). When 90% had been removed, the specific activity ratio was about 3. Isotopic fractionation during adsorption is possible, but in these experiments about 99% of the initial hydrogen was adsorbed on the Molecular Sieve before desorption by pumping off was begun. It seems likely, therefore, that the considerable fractionation observed occurs mainly during desorption. The effect is thus not likely to be important when the Sieve is used for manipulating small volumes of hydrogen isotopes, since complete desorption by warming will usually be employed. (auth)

23580 SOME APPLICATIONS OF RADIOISOTOPES IN PHYSICAL CHEMISTRY — TWO-PHASE EQUILIBRIA AND PACKED-COLUMN TECHNIQUES. Kurt A. Kraus, Harold O. Phillips, and Frederick Nelson (Oak Ridge National Lab., Tenn.). p.387-406 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

One of the most effective applications of radioisotopes in physical chemistry is the study of two-phase equilibria; our own studies for a number of years have been concentrated on ion exchange reactions with commercial organic and with new types of non-siliceous inorganic exchangers. With the former, the studies were carried out in depth, covering at times most elements in the periodic table, the objective being comparison of functional relationships of many systems rather than the detailed study of a few. With the inorganic exchangers, the objective was also broad coverage of many systems, particularly comparison of large numbers of adsorbents. Since these studies required hundreds of thousands of analyses, they would have been almost impossible with conventional analytical techniques. The feasibility of such studies can therefore be considered a direct outgrowth of the ready availability of radioactive tracers and the steady increase in precision and convenience of counting techniques. More recently, packed-column techniques have been developed which, with radioactive tracers and relatively simple equipment, permit ready extension of studies of two-phase equilibria and of the kinetics of interfaces to higher temperatures (at present up to 200°C). Sampling and continuous monitoring techniques were used. Through adsorption and solubility studies, information on enthalpy and entropy changes of adsorption and ion-exchange reactions is reported as well as information on heats of solution, activity coefficients in concentrated electrolyte mixtures, and on complexing reactions in high-temperature aqueous systems. (auth)

23581 APPLICATION OF RADIOISOTOPES TO THE INVESTIGATION OF THE KINETICS AND MECHANISM OF REACTIONS OF SOME INORGANIC COMPLEX COMPOUNDS. Gordon M. Harris (Univ. of Buffalo). p.407-14 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Radioisotopes are invaluable tools in the study of many types of inorganic chemical reactions, particularly those involving complex ionic substances in aqueous solution. One important approach is through research on the rates and mechanisms of isotopic exchange processes. For example, a series of studies has been made of the exchange between carbon-14-labelled "free" carbonate and the ligand carbonate in octahedral complex ions of the type $CoA_2CO_3^+$, where A = 2 NH_3, ethylenediamine (en), propylenediamine (pn), or trimethylenediamine (tn). These studies have led to a rather thorough understanding of the nature of this kind of ligand substitution reaction, and of the part played by the non-exchanging amine ligands in the process. Similar studies of oxalate exchange with tris-oxalato complexes of the form $M(C_2O_4)_3^{-3}$, where M = Co (III), Cr (III), or Rh (III), have been equally fruitful. An alternative technique, applicable only when using low-atomic-weight radioisotopes such as carbon-14, is to observe the equilibrium or kinetic isotope effects in the reaction of interest. It has, for instance, been possible to interpret differences in the ligand carbonate exchange mechanism of $Coen_2CO_3^+$ and $Cotn_2CO_3^+$ on the basis of equilibrium isotope-effect measurements made on the carbonate exchange reaction. Similarly, data on the kinetic isotope effect in the acid-catalyzed aquation of the $Co(NH_3)_4CO_3^+$ ion has supported deductions as to the nature of the rate-determining bond-breakage step in such reactions. Finally, the mechanistic path of certain atoms or radicals in inorganic reactions, where a choice between alternative explanations must be made, is frequently facilitated by a radioactive tracer experiment. An example is the proof that cyanide does not appear as a rapidly exchanging intermediate in the oxidation of thiocyanate ion by

hydrogen peroxide, although cyanide is an important end-product. (auth)

23582 SOME SOLVENT EXTRACTION STUDIES OF TRIVALENT METAL HALIDES. R. J. Dietz, Jr., J. Mendez, and J. W. Irvine, Jr. (Massachusetts Inst. of Tech., Cambridge). p.415-25 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Physical-chemical studies were made of the distribution of Ga (III) and In (III) between aqueous HCl and HBr solutions and the organic solvents, bis (2-chloroethyl) ether and nitrobenzene. From measurements of the extraction coefficients over a metal concentration range of greater than 10^{10} and under conditions where the coefficient varies by a factor of 10^5, the empirical behavior of these systems was thoroughly explored. The data are explained in terms of ionization of the complex acid, HMX_4, in these relatively high dielectric solvents. From the variation of the extraction coefficient with metal concentration, the ionization constant was calculated of the supporting electrolyte, HCl or HBr, in the non-aqueous phase using a method developed by Poskanzer. Variation of the extraction coefficient with HX concentration was used to calculate stability constants for the complex species MX_3 and MX_4^-. Since these are aqueous-phase reactions they are independent of the organic solvent used and excellent agreement is obtained for In (III)-HCl, using both bis (2-chloroethyl) ether and nitrobenzene. Attempts to evaluate the formation constants for gallium chloride and bromide complexes failed since the complex formation occurs over a very narrow range of acid concentration. Calculation from extraction data of the fraction, $(GaCl_4^-)/\Sigma$ Ga (III), as a function of HCl concentration gave a quantitative agreement with the data obtained from ion-exchange measurement by Kraus and Nelson. (auth)

23583 THE USE OF RADIOISOTOPES FOR DETERMINATION OF COMPLEX EQUILIBRIA. Jan Rydberg (Research Inst. of National Defence, Stockholm). p.427-34 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Radioisotopes can be used for determination of complex equilibria in solution, provided this solution is in equilibrium with another phase. The most versatile systems for studying aqueous solutions use solvent-extraction and ion-exchange methods. These two methods are seen to be more universally practical for determining complex equilibria than EMF, spectrophotometric and other more conventional ones. (auth)

23584 STUDY WITH RADIO-SULPHUR OF THE KINETICS OF THE PROCESS $SO_2 + 0.5\ O_2 \rightleftharpoons SO_3$ IN A STATE OF CHEMICAL EQUILIBRIUM ON A PLATINUM CATALYST. V. A. Roiter, N. A. Stukanovskaya, and G. P. Korneichuk. p.435-48 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In Russian)

An attempt was made to use radioisotopes in the study of the kinetics of heterogeneous catalytic processes in a state of equilibrium. The investigation was carried out by the circulation method. After establishment of equilibrium, a small amount of $S^{35}O_2$ was introduced into the system as a tracer and its conversion rate into $S^{35}O_3$ was measured. From the rate, the speed of the direct and inverse processes of oxidation of SO_2 on the catalyst was calculated. Possible sequence patterns for the process are suggested and discussed. (auth)

23585 ADSORPTION STUDIES AT IONIZED SURFACE LAYERS BY MEANS OF HOT ATOMS. Henashe Avrahami and Naftali H. Steiger (Israel Inst. of Tech., Haifa). p.449-61 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Adsorption of ions at the surface of solutions of ionic surface-active substances can directly be studied using hot atoms. Extremely small amounts of suitable radioactive ions, or ions liable to undergo induced nuclear transformations in situ, are added to such solutions, replacing some of the normal counter ions condsorbed at the primary-adsorbed organic ions. Hot atoms with energies from about 100 kev down to a few ev give ranges in water from about 1000 Å down to monomolecular layers. This makes them suitable for sensitive surface layer studies. The hot atoms ejected from the surface are collected and counted. Among α-disintegration recoils, the system Bi^{212}/Tl^{208} has proved to be suitable. Now, by refining the method, valuable information about adsorption conditions at sodium dodecyl sulfate surface layers could be found. The kinetics of adsorption was studied by following in time the collected recoil activity caused by Bi ion adsorption. Adsorption isotherms of Bi ions as a function of the bulk concentration of the surface-active substance under varying conditions of ionic strength, pH, and Bi^{212} activity were measured. By comparing these isotherms with those obtained by measuring the surface tension of the solutions and calculating the surface excess with the aid of a suitably modified Gibbs' isotherm, the adsorption of Bi^{3+} and Pb^{2+} relative to that of Na^+ and H_3O^+, and by this the extent of ion exchange in the adsorbed layer could be determined. As the method measures the adsorption of charged species, surface reactions transforming primary-adsorbed organic anions to be a non-ionic state could be followed. Conclusions could be drawn about the formation of a non-ionized acid soap in the surface and about micelle formation in the bulk under various experimental conditions. (auth)

23586 THE USE OF RADIOISOTOPES IN RADIATION CHEMISTRY: THE EFFECT OF RADIATION ON TOLUENE. K. E. Wilzbach (Argonne National Lab., Ill.). p.463-70 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Toluene labelled in the methyl group with tritium (one atom per 600 mol.), was prepared and was exposed in the vapor phase to gamma radiation (1.46 ev/mol.). The product was fractionated and the volatile fractions were injected into a gas fractometer equipped with an ionization chamber to permit simultaneous recording of radioactivity and thermal conductivity. Concentrations of tritium in the various products were determined from relative areas under peaks in the two curves. From the concentrations of tritium in these products it can be deduced that the methane is formed exclusively from the methyl group of toluene and that the xylenes are formed by attack of methyl radicals on toluene. Oxidation of the recovered toluene showed that transfer of tritium from the methyl group to the benzene ring had occurred to some extent during the irradiation. The benzoic acid contained one tritium atom per 140,000 molecules, corresponding to a G value of 0.3 for the "exchange" reaction. This appearance of tritium in the ring could result either from abstraction of methyl hydrogen by a tolyl radical or from reconversion of a symmetrical intermediate, such as the tropylium ion to toluene. (auth)

23587 STUDY OF PENTANE AND CYCLOPENTANE RADIOLYSIS WITH THE AID OF RADIOACTIVE IODINE. J. Dauphin (Faculté des Sciences, Paris). p.471-82 of "Radioisotopes in the Physical Sciences and Industry.

Vol. III." Vienna, International Atomic Energy Agency, 1962. (In French)

Irradiation of hydrocarbons by ionizing radiation such as Co^{60} gamma rays produces, inter alia, free radicals. Analysis of these radicals may lead to at least a partial explanation of the phenomena occurring. For analysis, the "isotopic dilution" method is used: the iodine used for taking up the radicals is labelled with iodine-131, resulting in a whole series of labelled iodides when the reaction is completed. Separation is affected by means of distillation on a microcolumn after inactive carriers have been added and the mineral iodine has been extracted. The activity of each fraction is measured directly it leaves the column. A control is used to obtain absolute G values from the counting. Precautions are taken to prevent isotopic exchange during separation. This method was applied to cyclopentane and n-pentane and yielded a detailed radiolysis spectrum. (auth)

23588 TECHNIQUE FOR THE STUDY OF HALOGEN ATOM REACTIONS. G. S. Laurence and D. R. Stranks (The University, Leeds, Eng.). p.483-93 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

A technique was developed for measuring the rates of gas phase reactions involving halogen atoms. The technique utilizes the effect of the nuclear (n, γ) reaction to generate radioactive atoms which then react with a substrate. Under certain conditions the atoms formed by the (n, γ) reaction do not undergo hot recoil reactions, but react only as normal thermal atoms. The kinetics of the reactions of the atoms may be evaluated by using a competing reaction whose kinetics are well established. The method depends for its successful application upon various conditions given. When those conditions are fulfilled the technique is very much simpler than photolysis. With a small laboratory-neutron source the concentration of the labelled atoms can be made so small that the direct recombination of the labelled halogen atoms can be ignored, so that accurate measurements of the radiation absorbed and the quantum yield for the production of the atoms are unnecessary, as are a knowledge of the recombination rate, or the use of a sector technique to measure this rate. The method has possible applications to the study of the reactions of halogen atoms with radicals, but this possibility has not so far been explored. The technique was developed in the study of the thermal exchange reaction between iodine atoms and methyl iodide, the exchange reaction between iodine atoms and molecules being used as a competing reaction ($I^{128} + I_2 \rightarrow II^{128} + I$). From the rate constant for this exchange, the rate constant and activation energy for the exchange with methyl iodide were determined, and the values confirmed by direct measurement. (auth)

23589 VAPOUR-PRESSURE DETERMINATIONS ON TRITIUM-LABELLED ORGANIC COMPOUNDS. A. S. Carson (Univ. of Leeds, Eng.), R. Cooper, and D. R. Stranks. p.495-502 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The recent thermochemical interest in organo-metallic compounds requires the measurement of very low sublimation heats and vapor pressures. For this purpose, a radiotracer technique may be used to advantage, tritium being especially suitable. Experiments were made with tetraphenyl lead and tin, labelled with tritium yielding high specific activities per exposure. The technique employed and the damage caused to the target material by irradiation are described. Vapor pressures as low as 10^{-10} to 10^{-11} mm Hg can be determined with accuracy, using a modified Knudsen effusion technique. The effusion cell and the results of assaying tritium in a proportional counter are described. The experimental values of the vapor pressures and latent heat of sublimation in the range 20 to 40°C are given. (auth)

23590 THE ELUCIDATION OF A SECONDARY CHEMICAL INTERACTION IN AN ION-EXCHANGE RESIN BY A RADIOISOTOPE-DILUTION METHOD. J. A. Marinsky and J. Krasner (Univ. of Buffalo). p.503-15 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Experiments were made to estimate the dissociation constants of the acid and mildly alkaline forms of the iminodiacetate functional groups linked to the copolymer matrix of the chelating resin Dowex A-1. The dissociation constants can be estimated by studying the controlled neutralization of the resin by means of a Na^{22}-labelled solution of NaOH in 0.1 M NaCl. The concentration of Na^+ and H^+ (or H_3O^+) ions in the resin and solution phases at equilibrium are evaluated from the pH of the solution and the observed distribution of Na^{22} between the two phases, and the dissociation constants are estimated accordingly. The dissociation constant of the acid form is found to be about 1.2×10^{-3} and that of the alkaline form about 10^{-14}. An unexpected acidic property of the resin, attributable to the nitrogen of the functional group, appears to be demonstrated from these data. (auth)

23591 SOLUBILITY OF METALLIC MERCURY IN ORGANIC SOLVENTS. E. H. Klehr and A. F. Voigt (Ames Lab., Ames, Iowa). p.517-29 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The solubilities of metallic mercury at 25°C in the solvents carbon tetrachloride, 2,2,4-trimethylpentane, n-decane, benzene, toluene, nitrobenzene, chlorobenzene, and bromobenzene were determined by the use of Hg^{203} tracer. Measurements were made either by shaking mercury metal of known specific activity with the solvent, or by measuring the distribution coefficient of the metal between the solvent and water and combining this measurement with the solubility of mercury in water, or by both methods. Radioactivity was measured by counting precipitated samples with a GM counter or liquid aliquots with a well-type scintillator counter. All solubilities were in the range 4.6 to 16×10^{-4}g atoms/l. For n-decane, toluene, and chlorobenzene, the temperature dependence of the solubility was determined over the range 0 to 45°C. The Hildebrand-Scott theory of solubility was applied to these systems for comparison. For the aliphatic hydrocarbons, the solubilities predicted by theory are within 35% of those observed, but for the other solvents, the predicted values are 4 to 18 times larger than those observed. Modification of the theory gives better agreement for some solvents but poorer agreement for others. Curves of log C (solubility) vs 1/T were straight lines with slopes similar to those obtained from the Hildebrand-Scott theory but displaced from those curves. The slopes of the curves were used for the calculation of heats and entropies of solution. Entropies were also calculated from curves of log C vs log T. The two sets of entropy values were in agreement with each other and were within one to four entropy units of the ideal entropies of mixing. (auth)

23592 THE VARIATION OF SOLUBILITY OF STRONTIUM SULPHATE WITH PARTICLE SIZE. B. V. Enuestuen and John Turkevich (Princeton Univ., N. J.). p.531-48 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Radioactive sulfur was used to study the variation of solubility of strontium sulfate with particle size. Synthetic methods were used to control the particle size (d = 160 to 1000 Å) and the size distribution was determined by electron microscopy. The separation of phases was carried out by sedimentation and the supernatant liquid was examined with the electron microscope to check for existence of peptized particles. The concentration of the dissolved $SrSO_4$ was determined by evaporation of an aliquot of the supernatant and determining the sulfur activity. The results were found to follow the Ostwald-Freundlich equation for solubility with the smallest particles in a given distribution determining the solubility. From the solubility data, an interfacial tension of 84 ± 8 erg/cm^2 was obtained, a value much lower than previously reported in the literature. The Ostwald-Freundlich equation was extended to crystals of any geometry. Using this extended equation the interfacial tension of the different faces of strontium sulfate was calculated. The data on variation of solubility with particle size and on the synthesis of particles of $SrSO_4$ were used to determine the size of the nucleus of $SrSO_4$. Semiquantitative observations showed that the rate of solubility is much faster than the rate of growth. (auth)

23593 RADIOISOTOPES IN THE PHYSICAL CHEMISTRY OF CORROSION PROCESSES AND THEIR INHIBITION. G. H. Cartledge (Oak Ridge National Lab., Tenn.). p.549-57 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

The fundamental study of the electrochemical processes of corrosion and inhibition involves various factors, including in particular: (a) adsorption phenomena of different types; (b) ion-exchange properties of passive films; and (c) the electrochemical kinetics of both anodic and cathodic processes across the interface between a metal and its corrosive environment. The availability of radioisotopes has made possible certain studies of these phenomena that could not be made previously with conventional techniques. The element technetium, a homologue of manganese in the periodic system, has been found uniquely suited to certain of these studies by reason of its nuclear properties. The chemical properties of technetium compounds are summarized and contrasted with those of corresponding Cr^{51} compounds and those of molybdenum and tungsten, so much used in studies of inhibition. Selected experimental studies are given as examples of the uses to which technetium has already been put in this type of work. Among these are empirical studies of its action as a very efficient inhibitor of the corrosion of iron, together with the results of long-term observations of surface activity. Other studies with both Tc^{99} and I^{131} have demonstrated the significance of competitive adsorption of ions in the determination of the kinetics of the corrosion and inhibitory processes. Finally, it is shown how the unique properties of technetium have permitted a clear discrimination between the relative contributions of oxygen and the oxidizing inhibitor in the maintenance of passivity. (auth)

23594 RADIO-TRACER TECHNIQUES IN THE STUDY OF CORROSION BY MOLTEN FLUORIDES. W. R. Grimes, G. M. Watson, J. H. DeVan, and R. B. Evans (Oak Ridge National Lab., Tenn.). p.559-74 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

When Inconel or Inor-8 alloys are exposed to a mol fluoride mixture containing reducible material, chromium is selectively oxidized and removed from the alloy. By the use of radio-tracer Cr^{51}, the self-diffusion coefficients for chromium in Inconel and Inor-8 and the applicability of these values to alloys under corrosive conditions were evaluated. Over-all coefficients were obtained (1) by measuring depletion of Cr^{51} (charged as CrF_2) for non-corrosive fluoride melts in alloy capsules and (2) by comparison of measured total radioactivity of exposed alloy specimens with that of the salt to which they were exposed. In addition, coefficients were obtained from measurement of tracer concentration profiles through successive electropolishings of the specimens. The over-all coefficients and those obtained from electropolishing experiments agree very well for Inconel at high temperatures and for Inor-8 at all temperatures. For temperatures below 750°C, coefficients obtained by electropolishing Inconel specimens are higher than the over-all values; the bulk diffusion process is not uniform for this case. In all cases, good agreement was found between the over-all diffusion coefficients and those extrapolated from published data at higher temperature with generally similar Cr–Ni alloys. Duplicate, polythermal loops of Inor-8 were used to circulate a non-corrosive fluoride melt containing Cr^{51} (as CrF_2). One of these loops was sacrificed to evaluate take-up of Cr^{51} by the alloy; the second was used to circulate a melt containing FeF_2 to obtain measurable removal of Cr from the alloy. Good agreement between observed behavior and that predicted from the measured diffusion coefficients was obtained; this agreement suggests that the self-diffusion coefficient for Cr is insensitive to changes in chromium content of the Inor-8 alloy. (auth)

23595 RADIOISOTOPES AS TRACERS FOR REACTIONS IN MOLTEN FLUORIDE MEDIA. W. R. Grimes, J. H. Shaffer, R. A. Strehlow, W. T. Ward, and G. M. Watson (Oak Ridge National Lab., Tenn.). p.575-90 of "Radioisotopes in the Physical Sciences and Industry. Vol. III." Vienna, International Atomic Energy Agency, 1962. (In English)

Chemical reactions which may be useful for removing certain constituents from molten fluoride solution were examined by use of appropriate radioisotopes and standard counting procedures. Classes of reactions studied included (1) isotopic exchange between solute tracer and insoluble compound, (2) partition of solute between the melt and a solid solution of a similar compound, and (3) precipitation of the radioisotope as insoluble compound. In typical experiments, radiotracer LaF_3 in LiF–NaF melts was shown to exchange rapidly with inactive La_2O_3. A similar rapid exchange in this solvent occurred between radiotracer CeF_3 and inactive CeO_2; the electron transfer required in the latter case is apparently no barrier to the reaction. Addition of inactive CeF_3 to each system increased the radiotracer content of the solution in accordance with the mass-action principle. When certain LiF–BeF_2 melts containing CeF_3 and rare-earth fluorides are cooled, the primary phase is a solid solution of the trifluorides. Equilibria, between molten solution and solid solution, were evaluated for various fluoride pairs. No significant deviations from the simple mass-action principle were observed. Separations of various species by selective precipitation of oxides from molten fluoride solutions were also demonstrated. (auth)

Analytical Procedures

Refer also to abstracts 23383, 24065, 24562, 24563, 24565, 24573, 24574, 24575, 24576, 24577, and 24578.

23596 (AERE-R-3499) THE ISOLATION OF MICRO QUANTITIES OF URANIUM WITH PARTICULAR REFERENCE TO THE DETERMINATION OF ALPHA RADIO-

ACTIVITY DUE TO URANIUM IN CERTAIN NATURAL MATERIALS. C. G. Wallace (United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England). Mar. 1962. 23p.

Precipitation procedures are described for the concentration of micro quantities of uranium from macro quantities of many elements. The uranium is finally isolated as the diethyl dithiocarbamate complex. The procedure was applied to the determination of alpha activity due to uranium in vegetation, soil, and river water and was found to be specific for uranium in these materials. (auth)

23597 (AERE-R-3974) THE DETERMINATION OF ARSENIC IN STEELS BY X-RAY FLUORESCENCE SPECTROGRAPHY. J. Watling (United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England). Apr. 1962. 5p.

The instrumental conditions for the determination of 10 to 200 ppm of arsenic in lead-free steels by x-ray fluorescence spectrography are described. The samples are converted to the oxide and compensation for mass absorption effects due to alloying constituents is made by the use of gallium as internal standard element. Synthetic standard mixtures are employed for calibration. Under the experimental conditions recommended, the limit of detection is 10 ppm and the precision over the range 50–200 ppm is 5%. (auth)

23598 (ARDC/P.36) THE DETERMINATION OF ARGON IN CARBON DIOXIDE BY RADIOACTIVATION ANALYSIS. F. J. Woodman (United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England). Sept. 7, 1954. 7p. (WSL/TM.289)

A procedure for the determination of traces of argon in carbon dioxide is described in which a sample is irradiated for several hours in the pile with a sample of air as a standard. The induced argon activity in each sample is measured and the argon content of the carbon dioxide is calculated. As little as 0.1 ppm of argon in a 10 ml sample of carbon dioxide can be determined by the method. (auth)

23599 (ARL-180) ANALYTICAL METHODS APPLICABLE TO ZIRCONIA OXIDE AND BORON–SILICON REFRACTORIES. Paul T. Close, M. T. Watson, and C. H. Drummond (Owens-Illinois Glass Co., Toledo, Ohio). Dec. 1961. Contract AF33(616)-7431. 49p.

A complete evaluation of the analytical methods employed in the analyses of zirconia–magnesia refractories and of boron–silicon mixtures is presented, along with analytical data of submitted samples. Preferred methods of analyses for $ZrO_2 \cdot MgO$ refractories are: for ZrO_2, precipitation by mandelic acid; silica by silico–molybdate colorimetry; MgO by phosphate; and for the determination of free MgO, a method of short digestion period followed by EDTA titration. Methods found suitable for analysis of the boron–silicon system are: silicon by sodium carbonate–nitrate fusion and dehydration as silicic acid; boron by a similar fusion, precipitation of silicon, and titration of boric acid; nitrogen by a caustic fusion and determination as NH_3; and oxygen by fluorination and measurement of the released gas. (auth)

23600 (CNI-57) METODO COLORIMETRICO PER LA DETERMINAZIONE DI MICROQUANTITÀ DI URANIO IN MATERIALI ORGANICI E INORGANICI, MEDIANTE 1-(2-PIRIDILAZO)-2-NAFTOLO(PAN). (Colorimetric Method for the Determination of Microquantities of Uranium in Organic and Inorganic Materials, Based on 1-(2-Pyridylazo)-2-Naphthol(PAN)). V. Camera (Italy. Comitato Nazionale per l'Energia Nucleare. Centro di Studi Nucleari, Ispra). Dec. 1961. 26p.

A sensitive and accurate method is described for the colorimetric determination of uranium in urines, and, more generally, in various organic and inorganic materials. The method is based on the ability of 1-(2-pyridylazo)-2-naphthol (PAN) to give a color complex with uranium, at pH 9, in the presence of EDTA, which, in turn, is able to complex the metallic impurities which may be present. When these impurities are rather abundant, the method involves an initial extraction of uranium (as uranyl nitrate by tributylphosphate) (PAN). The sensitivity of the method is high (2γ of uranium); the precision is remarkable, even in the case where the preliminary extraction by means of TBP is necessary. In order to increase the sensitivity of the method (the main critical factor being pH) many complementary tests and check analyses were carried out. Similarly the interference of different metallic ions, the specificity of the color reaction, and the competition between EDTA and PAN in complexing uranium were investigated. The determination technique in urine samples of workers in uranium metallurgy works is particularly described, as well as the technique of analysis of air samples, collected in environments contaminated by uranium-containing dust. (auth)

23601 (HW-69677) ANALYTICAL METHODS FOR ALKALINE EARTH DETERMINATIONS IN SUPPORT OF THE STRONTIUM-90 RECOVERY PROGRAM. R. Ko, A. C. Leaf, W. Y. Matsumoto, H. A. Treibs, and M. R. Weiler (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 1961. Contract AT(45-1)-1350. 23p.

Methods were established for the determination of Sr, Ba, and Ca in Sr^{90} recovery samples. Emphasis was placed on speed and simplicity at some sacrifice in precision and accuracy. Trace concentrations of Ca and Sr in process chemicals were determined flame photometrically after separation by co-precipitation with an estimated relative standard deviation of ±20%. Recoveries of Ca and Sr through the procedures were 90 and 75 to 95%, respectively. A cation exchange separation of Ba and Ca from gross amounts of Na was also demonstrated. Moderate concentrations of Ca in cold pilot plant solutions were determined directly by flame photometry using butyl cellosolve. An emission spectrographic method for Ba, Ca, and Sr was also established, and an x-ray fluorescence method for Sr was developed. For highly radioactive process solutions, Ba and Ca were separated by cation exchange and determined flame photometrically with a relative standard deviation of ±10%. Recoveries were 95%. Radiostrontium was determined by beta counting after separation by anion and cation exchange with a relative standard deviation of ±3% and recovery greater than 99%. (P.C.H.)

23602 (IA-639) A RAPID CHROMATOGRAPHIC METHOD FOR THE DETERMINATION OF MINUTE QUANTITIES OF TELLURIUM IN THE PRESENCE OF LARGE AMOUNTS OF BISMUTH. S. Goren (Israel. Atomic Energy Commission, Tel Aviv). July 1961. 4p.

A selective separation of tellurium from bismuth using an ascending paper chromatographic method is described. The separation takes place in a solvent mixture of isopropyl ether and ethanol acidified with hydrochloric acid. When the chromatogram is sprayed with an acidified solution of $SnCl_2$, only one dark spot is obtained. This spot corresponds to tellurium, resulting from its reduction to the elementary state. The intensity of the color and the area of the spot are proportional to the quantity of tellurium present, since bismuth is not reduced under acidic conditions. The spot of bismuth may be detected by spraying

the paper with an alkaline solution of $SnCl_2$ using $PbCl_2$ as a catalyst. The R_f value obtained for tellurium is 0.9, and for bismuth 0.7. (N.W.R.)

23603 (JEN-91-DQ/I-25) CONTRIBUTIONS TO THE ANALYTICAL CONTROL OF POLYPHENYLIC MIXTURES. R. Barrera Piñero (Spain. Junta de Energiá Nuclear, Madrid). 1961. 22p.

Separation and identification experiences of polyphenylic mixtures are described. The following techniques were used: vacuum fractional distillation, vacuum sublimation, and chromatography on acetylated paper. Also new colored reactions of polyphenyls with aldehyde chlorides and their spectrophotometric applications were studied. (auth)

23604 (NP-11873) THE ANALYTICAL DETERMINATION OF URANIUM IN IRON AND STEEL ALLOYS. J. C. Ingles, J. B. Zimmerman, and J. L. Horwood (Canada. Dept. of Mines and Technical Surveys. Mines Branch). Dec. 1961. 110p.

Available as Can. Dept. Mines and Tech. Surveys, Ottawa, Mines Branch, Inform. Circ. IC-134. $0.25.

The chemical properties of uranium are summarized and literature on its determination and separation which are of interest in connection with the analysis of iron, steel, and iron alloys are reviewed. Typical analytical procedures, illustrating the best known methods for separation and determination, and using standard analytical equipment and techniques, are presented. In addition, x-ray and radiometric methods, capable of providing analytical results within a few minutes, are also described. 142 references are given. (P.C.H.)

23605 (PG-Report-186) ANALYTICAL METHOD FOR THE DETERMINATION OF URANIUM IN AQUEOUS EFFLUENTS (ABSORPTIOMETRIC-DIBENZOYLMETHANE). (United Kingdom Atomic Energy Authority. Production Group, Capenhurst, Ches., England). 1962. 5p.

A sample of the effluent is evaporated to low bulk and uranium extracted from the solution with tri-butyl phosphate/iso-octane reagent. Uranium in the organic extract is then determined absorptiometrically as the dibenzoylmethane complex. (auth)

23606 (PG-Report-188) ANALYTICAL METHOD FOR THE DETERMINATION OF URANIUM IN HERBAGE (ABSORPTIOMETRIC-DIBENZOYLMETHANE). (United Kingdom Atomic Energy Authority. Production Group, Capenhurst, Ches., England). 1962. 5p.

A sample of oven-dried herbage is ignited and the ash leached with nitric acid. Uranium is extracted from the solution with tri-butyl phosphate/iso-octane reagent and determined absorptiometrically as the dibenzoylmethane complex. (auth)

23607 (PG-Report-187) ANALYTICAL METHOD FOR THE DETERMINATION OF URANIUM IN MILK (ABSORPTIOMETIC-DIBENZOYLMETHANE). (United Kingdom Atomic Energy Authority. Production Group, Capenhurst, Ches., England). 1962. 5p.

A sample of milk is evaporated to dryness, ashed, and the residue dissolved in nitric acid. Uranium is extracted from the solution with tributyl phosphate-isooctane reagent and determined absorptiometrically as the dibenzoylmethane complex. The method is applicable for milk containing 0.1 to 5 μg/ml of uranium. Concentrations outside this range may be determined by suitable adjustment of the sample portion. The method is accurate within 15% at the 20 μg level. (auth)

23608 (PG-Report-228) ANALYTICAL METHOD FOR THE DETERMINATION OF FLUORIDE IN URANIUM ORE CONCENTRATES. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 6p.

The sample is dissolved in sulfuric acid and the fluoride distilled and collected in sodium hydroxide solution. A suitable aliquot of the distillate is adjusted by pH 3.0 and titrated with thorium nitrate solution using alizarin red S as indicator. (P.C.H.)

23609 (PG-Report-323) ANALYTICAL METHOD FOR THE DETERMINATION OF URANYL FLUORIDE IN URANIUM TETRAFLUORIDE. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1962. 4p.

Uranyl fluoride is extracted by trituration with saturated sodium fluoride solution in a mechanical agate mortar. The suspension is filtered and the soluble uranium is determined absorptiometrically in the filtrate using sodium carbonate and hydrogen peroxide. (P.C.H.)

23610 (PG-Report-335) ANALYTICAL METHOD FOR THE DETERMINATION OF DISSOLVED OXYGEN IN BOILER FEED WATER AND CONDENSATES. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 7p.

A sample of water is taken in a specially designed bottle. A solution containing potassium hydroxide, potassium iodide, and potassium iodate is added, followed by a solution of manganous sulfate and then sulfuric acid. During the addition of the reagents nitrogen is passed over the surface of the sample to prevent interference by atmospheric oxygen. Iodine is released equivalent to the dissolved oxygen and is determined by adding an excess of sodium thiosulfate and back titrating with potassium iodate using an amperometric end point. Precision is ±0.001 ppm. The method is valid for the concentration range 0.003 to 0.03 ppm for the type of water used at Calder and Advanced Gas Cooled Reactors. Higher concentrations can be determined by slight modifications to the method, but normally less exacting procedures are adequate for the higher oxygen levels. (auth)

23611 (PG-Report-342) ANALYTICAL METHOD FOR THE DETERMINATION OF HYDRAZINE IN 35% HYDRAZINE SOLUTIONS. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 4p.

Hydrazine is acidified with hydrochloric acid and titrated with standard potassium iodate solution. Free nitrogen and a chloride complex of iodine monochloride are produced. In the presence of excess hydrazine, the iodine monochloride is reduced to free iodine, and when all the hydrazine is used, free iodine is titrated. The end point is obtained by adding a small amount of carbon tetrachloride, in which the iodine released dissolves to give a violet solution. When the titration is complete all the iodine is converted into iodine monochloride complex and the violet color disappears. (P.C.H.)

23612 (PG-Report-344) ANALYTICAL METHOD FOR THE DETERMINATION OF TRIBUTYL PHOSPHATE IN MIXTURES WITH ODOURLESS KEROSENE (INFRA-RED ABSORPTION SPECTROMETRY). (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 5p.

A method for the determination of tributyl phosphate in mixtures with odorless kerosene by infrared spectrometry is presented. The sample is washed with sodium carbonate solution and water. The absorption by the washed sample of radiation at a frequency of 1275 cm^{-1} due to the P=O bond is measured. (auth)

23613 (TID-7629) ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. FIFTH CONFERENCE, GATLINBURG, TENNESSEE, OCTOBER 10-12, 1961. (Oak Ridge National Lab., Tenn.). 363p.

Proceedings of the Fifth Conference on Analytical Chemistry in Nuclear Reactor Technology are presented. Thirty one papers and abstracts of 16 papers are included. Separate abstracts were prepared for 28 papers. Three were previously abstracted for NSA. (M.C.G.)

23614 (TID-7629(p.1-15)) AN AUTOMATED SPECTROGRAPH FOR THE DETECTION OF BERYLLIUM SMEAR AND FILTER PAPER SAMPLES. C. S. McMurray and J. H. Rowan (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.).

An automated spectrograph was developed for the analyses of beryllium contained on filter paper discs. With this instrument, unattended analyses can be carried out on a number of samples following a simple sample preparation. Filter paper discs representing beryllium in the atmosphere as well as those used for evaluating surface contamination are accommodated. Included in the unit are an automatic electrode changer, analytical gap servo control, spectrograph, signal detector, and computer and readout system. The performance of the instrument in the range 0.5 to 40 μg of beryllium is discussed. (auth)

23615 (TID-7629(p.16-21)) AN INSTANTANEOUS DIRECT-READING BERYLLIUM AIR MONITOR. J. H. Rowan and W. W. Lee (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.).

An instantaneous, direct-reading instrument for monitoring the level of beryllium contamination in the atmosphere is described. This instrument is similar in principle to the instrument of Chruchill and Gillieson. A high-intensity spark discharge is used to excite the beryllium in the air sample, which is introduced through hollow electrodes. The beryllium spark excitation at 3130 to 3131 A is detected by a photomultiplier tube at the exit slit of a ½-m, Ebert-mounted, grating monochromator. The response is displayed on a strip chart recorder calibrated in micrograms of beryllium per cubic meter of air. Based on the response observed during calibration studies, one microgram of beryllium per cubic meter of air or less can be detected with reasonable certainty. The instrument was calibrated up to 25 μg Be/m^3 and the 95% confidence limit for a single measurement over this range was approximately ± 1.3 micrograms. (auth)

23616 (TID-7629(p.22-30)) DEVELOPMENTS IN HIGH-RESOLUTION SPECTROSCOPY FOR THE ROUTINE DETERMINATION OF URANIUM-235. W. Fletcher and R. Franklin (United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England).

The construction of a high-resolution spectrograph which is capable of resolving the isotopic lines of uranium is described. The spectrograph employs an echelle-type grating in a 3-m Ebert mounting with interchangeable photoelectric and photographic recording heads. A dispersion of 0.30 A/mm was obtained in the 16th order. Special attention was given to maintaining thermal stability. The photoelectric recording head was designed to admit the U^{235} and U^{238} isotopic radiations and the background radiation from a neighboring region free from spectral lines. A beam splitting prism was used to direct these radiations on to three photomultiplier tubes. The electronic circuit allows each photomultiplier to charge a high-precision condenser. At a predetermined point the integration was stopped and the accumulated potential on each condenser was amplified and recorded. The electronic recording unit consists of a small analogue computer assembly using commercially available d-c operational amplifiers. These amplifiers can be regarded as performing mathematical operations on the input voltages supplied to them. Since the accuracy of these operations is largely independent of the characteristics of the amplifiers, substitution of a faulty unit by a spare unit is entirely satisfactory. This and other advantages of the system are discussed. Automatic control of the measurement cycle and of the recording of the results led to a saving in operating costs and to improved accuracy. A commercial digital voltmeter and an electrically operated adding machine for analogue-to-digital conversion and the recording of the results were used for this. (auth)

23617 (TID-7629(p.31-41)) HIGH-RESOLUTION, HIGH-SENSITIVITY, SCANNING, RECORDING, FLAME SPECTROPHOTOMETER. H. C. Jones, D. J. Fisher, and M. R. Kelley (Oak Ridge National Lab., Tenn.).

A high-resolution, single-beam flame spectrophotometer making maximum use of unaltered commercial components is described. The following components were incorporated into the design of this instrument: oxygen–hydrogen flame source; scanning spectrometer; multiplier phototubes; d-c power supply; power supply; operational amplifiers; and a recorder. The spectral range from 2700 to 8700 A is covered in the first order. The spectrometer has a linear reciprocal dispersion of 16 A/mm and a resolution of at least 0.2 A (10-μ slits) in the first order. A chopped-light-beam system was used to eliminate the effects of variable dark current (which are particularly troublesome with infrared-sensitive tubes) and also to render the instrument applicable for either emission or atomic absorption photometry. The output from the multiplier-phototube is amplified by an operational amplifier used as a current amplifier. The current amplifier is followed by two units connected as tuned a-c voltage amplifiers. The a-c signal is rectified by a transistor used as a synchronous rectifier. The output of the rectifier is fed to the inputs of two operational amplifiers. One is connected as an inverting d-c amplifier and the other as a time integrator. A micro-switch operated by a timer is used to switch the recorder input from the d-c inverting amplifier output long enough for the accumulated output of the integrator to be read. Another micro-switch selects the time interval for integration of the signal. The signal being integrated is also recorded directly so that the occurrence of an abnormal event during the integration period will be known and the corresponding integrator reading can be discarded. Means is provided for measuring spectral intensities from selected areas of the flame. This instrument was designed to be sensitive at wavelengths up to 852 mμ so that it can be used with an exhaust filter for the analysis of radioactive samples containing cesium. The performance of this instrument is discussed in terms of its linearity, resolution, sensitivity, and readout options. (auth)

23618 (TID-7629(p.42-53)) AN IN-CELL GAMMA ANALYZER. U. L. Upson and F. P. Roberts (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.) (HW-SA-2185)

A close-coupled gamma spectrometer for viewing samples inside the hot cell was utilized to provide analytical control in the Hanford Laboratories' High-Level Radiochemical Facility, yielding rapid and accurate isotopic analyses of undiluted samples. Design criteria, based on an expected maximum cell activity of 100 kilocuries of Ce–Pr^{144} (2.2 Mev) and a sample activity range from 0.2 to 2000 mc/ml, were exceeded. At twice the anticipated maximum cell activity (~1000 r/hr at the sample station) it was possible to

detect as little as 0.01 mc/ml and to evaluate 0.1 mc/ml isotopic activity in the sample; sample activities exceeding 10 curies/ml can be tolerated. Two through-the-wall access tubes were utilized to accomodate two detectors, each of which views two sample positions. The two positions for each detector were designed to yield geometries differing by a factor of 10, and the two detectors were collimated to differ by about 100, yielding four sample positions in approximate decade steps. Pulse-height analysis of the detector outputs is performed by a 400-channel analyzer operating at 1.00 Mev per 100 channels, and utilizing instrumental background subtraction to yield direct printout of the net gamma spectra. Isotopic analysis usually requires only a 1- or 2-minute counting period. The instrument proved to be an extremely valuable and reliable tool in both research and chemical processing operations. (auth)

23619 (TID-7629(p.55-61)) THE SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF TUNGSTEN IN TANTALUM USING THIOCYANATE. E. A. Hakkila, G. R. Waterbury, and G. B. Nelson (Los Alamos Scientific Lab., N. Mex.).

Microgram quantities of tungsten in tantalum metal and various tantalum alloys were determined using a method which combines the thiocyanate spectrophotometric method for tungsten with the use of several complexing agents to hold the tantalum in solution. This combination of methods permits the determination of tungsten concentrations greater than 10 ppm without separation of the tantalum. The molar absorptivity of the tungsten-thiocyanate complex is reduced to 11,240 in the presence of these complexing agents as compared to a reported value of 13,800 in the absence of these agents. The relative standard deviations for determining 10, 200, and 400 μg of tungsten in 1-gram tantalum samples are 14, 2.1, and 1.4%, respectively. The effects of 27 diverse ions on the determination were investigated. The method is rapid, allowing one analyst to perform 30 to 40 determinations per day. (auth)

23620 (TID-7629(p.62-8)) THE SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF MOLYBDENUM AND TUNGSTEN IN PLUTONIUM USING DITHIOL. G. B. Nelson and G. R. Waterbury (Los Alamos Scientific Lab., N. Mex.).

A modification of the spectrophotometric method for determining trace concentrations of molybdenum and tungsten as the dithiol complexes was applied to plutonium. The molybdenum(VI)-dithiol complex was extracted from 5 to 6 M HCl, and the tungsten(V)-dithiol complex from 9 to 11 M HCl into pentyl acetate. Measurement of the absorbances of the complexes in the extracts completed the determinations. Plutonium had no significant adverse effect on the method, and the molar absorptivities obtained were in essential agreement with the published values. The relative standard deviations of the method were determined to be 3.4 and 1.5% for 5.1 and 51 ppm of molybdenum in plutonium, respectively, and 3.0 and 1.4% for 11.8 and 118 ppm of tungsten in plutonium, respectively. The effects of several diverse ions on these determinations are tabulated, extending the previous investigations of interferences with this method. (auth)

23621 (TID-7629(p.69-80)) X-RAY SPECTROMETRIC DETERMINATION OF ZIRCONIUM IN REFINED URANIUM MATERIALS. G. R. Blank and H. A. Heller (National Lead Co. of Ohio, Cincinnati).

A method is presented for the x-ray spectrometric determination of zirconium in uranium metal and other refined uranium materials. After a chemical separation of the zirconium from uranium with a 2-thenoyltrifluoroacetone (TTA) extraction, the zirconium is determined in the organic (TTA) phase. Determinations of zirconium in the range from 5 to 100 ppm are derived from the ratio of ZrK_α to background intensities. The actual limit of detection is 2 μg Zr/ml in the organic solution. The limit of error for a single determination at the 95% confidence level was found to be 1.7 ppm zirconium in the range from 5 to 100 ppm Zr (corresponding to 0.7 μg Zr/ml in the range from 2 to 40 μg Zr/ml). One operator can prepare and analyze 14 samples in an eight-hour day. (auth)

23622 (TID-7629(p.81-90)) THE UTILIZATION OF RADIOISOTOPE-EXCITED X-RAYS IN REACTOR FUEL ANALYSIS. James C. McCue (Tracerlab, Inc., Waltham, Mass.).

An instrumental method of analysis is described which utilizes a radioisotope-excited x-ray source for nondestructively determining the total loading of fuel ingots. Low-energy x rays, generated by beta bombardment from clathrated Kr^{85}, are backscattered from the ingots and detected in a conventional manner. Spectroscopy is employed to permit discrimination of Rayleigh-scattered and uranium-characteristic x radiations. Determinations are not dependent on uranium enrichment or radioactivity. A stable irradiation flux is provided at low cost through the use of a radioisotopic source. Handling hazards are minimized by using a metabolically inert radioisotope, Kr^{85}, in solid form. Instrumentation and other required components are of conventional design; the complexity is dependent on the degree of sophistication desired in the readout equipment. An instrument for carrying out a feasibility demonstration was designed and fabricated. Details of this gage, performance specifications, and initial data derived from an "on-stream" evaluation program are discussed. Other applications of radioisotopic x-ray sources in reactor fuel technology are reviewed. (auth)

23623 (TID-7629(p.91-109)) HEAVY WATER ANALYZER WITH INTERFERENCE FILTER. M. Ceccaldi and Paul Goujon (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Translated by A. L. Monks (Oak Ridge National Lab., Tenn.).

An apparatus designed to provide for the continuous control of the isotopic purity of heavy water in nuclear reactors was developed. The measurement of purity is based on the difference in the absorption of infrared radiations of 3400 cm^{-1}, which corresponds to an HDO band. Two spherical mirrors form an image of the source, which consists of an incandescent lamp. One of the two beams passes through a container holding the mixture to be analyzed (path length about 0.2 mm); the second beam passes through a variable optical attenuator and, afterwards, a fixed optical attenuator. The two beams pass through an interference filter, the passing band of which is centered on the frequency of the absorption band. A rotating semicircular shutter sends alternately each beam onto a pneumatic detector which is not energy selective. The shutter is opaque to the wavelength considered and transparent to shorter wavelengths, which it allows to pass continuously; this enables compensation for parasitic effects due to the nonopacity of the filter outside the passing band. The detector generates an electrical signal by the periodic variation of capacity. This signal is zero if the two beams are equal. If they are unequal, the phase of the signal depends on the sign of inequality of the two beams. A servo mechanism controlled by this amplified current activates the variable optical attenuator, which maintains automatically the equality of the two beams. The measured value is indicated by the position of the attenuator; this can be remotely recorded. (auth)

23624 (TID-7629(p.135-41)) EMISSION SPECTROGRAPHIC IMPURITY ANALYSIS OF DENSE BERYLLIUM OXIDE. O. V. Coble, W. A. Taebel, and J. W. Sausville (Curtiss-Wright Corp. Research Div., Quehanna, Penna.).

A study was initiated to evaluate mechanical grinding vs acid dissolution of hot-pressed BeO as methods for sample preparation for spectrographic analysis. The former method appeared more favorable with respect to the time element and sensitivity, and further study was undertaken to devise a rapid method of grinding or powdering hot-pressed BeO without introducing contaminants. For initial testing, a mixer/mill with tungsten carbide grinding vial, caps, and ball-pestles was utilized. Resultant introduction of W and Co contaminants caused an unfavorable "matrix effect" and also precluded analyzing for Co. A series of experiments were performed in which plastics were used for the vial and as inserts for the tungsten carbide caps. It was discovered that two pieces of hot-pressed BeO act as ball-pestles and grind each other to powder with the shaking action of the mixer/mill. Consequently, tungsten carbide ball-pestles are not required. Comparison of spectrographic analyses of impurities found in "raw" BeO powder with impurities found in the same material after it was hot pressed and powdered in an all-plastic grinding system showed remarkable agreement. Sieve materials of various types were used for screening powdered hot-pressed BeO. The results obtained thereby are discussed. (auth)

23625 (TID-7629(p.142-50)) SOLID-SAMPLE MASS SPECTROMETRY IN NUCLEAR REACTOR TECHNOLOGY. T. Leo Collins, Jr., Fredric D. Leipziger, and Francis M. Rourke (Knolls Atomic Power Lab., Schenectady, N. Y.).

The application of solid-sample mass spectrometry to typical analysis problems is described. Such problems include burnup of U and B, trace analysis, burnable-poison studies, cross-section measurements, fuel-element homogeneity, abundance measurements, etc. Brief descriptions of the mass spectrometers utilized for these purposes are also included, together with information on the sensitivity of the method with respect to most of the elements of interest in reactor design. A proposed method is described for extending mass-spectrometric techniques to the determination of the cross section of certain isotopes. This involves the isolation of submicrogram quantities of the isotope of interest on the surface of a mass-spectrometer filament, irradiation of the filament, and subsequent mass-spectrometric analysis. (auth)

23626 (TID-7629(p.152-65)) THE DETERMINATION OF BURNUP IN NUCLEAR-FUEL TEST SPECIMENS USING STABLE FISSION-PRODUCT ISOTOPES AND ISOTOPIC DILUTION. A. J. Fudge, A. J. Wood, and M. F. Banham (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The radiochemical determination of burnup suffers from several limitations, which result in a lack of precision and a greater lack of accuracy. These limitations are due mainly to uncertainties in irradiation power levels and nuclear data such as half-life. An attempt was made to combine the advantages of using a direct product of fission as a measure of the degree of irradiation with the potentially more precise nuclear data for the stable fission-product nuclides. The choice of elements for use as indicators was made on a basis which allowed for multiple fissionable nuclides and neutron-energy effects and permitted the use of mass spectrometry to measure the stable nuclides by isotopic dilution analysis. The elements selected were molybdenum and neodymium. Mo^{92} and Nd^{142} tracers were added to the specimens at the time they were dissolved in acid. After suitable chemical separations, the ratios of the tracers to the stable fission-product isotopes were measured. $Mo^{95,97,98,100}$ and $Nd^{143,145,146,148,150}$ abundances, determined in this way, were then used to calculate values for the burnup, using the equation, % burnup = $100\ A_M/FY_MN$, where A_M = total number of atoms of indicator nuclide, FY_M = fission yield of indicator nuclide for the major fissile nuclide, and N = total number of uranium and/or plutonium atoms in specimens. The precision of values is 2% for isotopes of the same element, and 3% between the elements. The results obtained by this method for a limited number of UO_2 specimens were compared with those obtained by radiochemical procedures for a number of radioactive fission-product nuclides. The method was also used to study the migration of elements during irradiations of UO_2 specimens, with particular interest in the use of molybdenum and neodymium as burnup indicators. (auth)

23627 (TID-7629(p.166-76)) DETERMINATION OF BURNUP USING STABLE FISSION PRODUCT MOLYBDENUM. R. S. Forsyth, D. G. Guthrie, and A. E. Ross (United Kingdom Atomic Energy Authority. Reactor Group, Dounreay, Caithness, Scotland).

There is a requirement for accurate postirradiation methods of determining the number of fissions which have taken place in fuel materials undergoing irradiation testing in nuclear reactors, especially when high burnup of fissile atoms and varying irradiations are being encountered. To measure this, the determination of the stable molybdenum isotopes of mass numbers 97, 98, and 100 formed in the fuel specimens by fission was studied, using isotopic dilution techniques with "natural" molybdenum and mass spectrometry. These isotopes have the advantages of high fission yields, low cross section for neutron capture reactions, no volatile precursors, and the fact that both Mo^{98} and Mo^{100} are primary fission products. Being stable fission products, molybdenum isotopes have the additional advantage over the more conventional radioactive fission products that a detailed irradiation history is of secondary importance in the calculation of burnup and the "cooling time" is unimportant. The irradiated specimen is dissolved in HNO_3 and a known amount of "natural" molybdenum is added to the solution. Isotopic exchange is accomplished by oxidation cycles; then the molybdenum is separated from other fission products by solvent extraction techniques, using acetyl acetone. The extraction stage is conveniently carried out by remote handling, the only quantitative operations being the pipeting of the sample and the "natural" molybdenum solution. After ignition at 500°C, the residue from the solvent extraction is transferred to a single tantalum filament and mounted in a mass spectrometer type. Measurement of the ratios Mo^{97}/Mo^{92}, Mo^{97}/Mo^{94}, Mo^{98}/Mo^{94}, etc., of the extracted fission products to the isotopic components of the added natural molybdenum and measurement of the isotopic composition of the natural molybdenum enables calculation of the number of Mo^{97}, Mo^{98}, or Mo^{100} fission-product atoms in the sample of irradiated material. From the known fission yields of these atoms the burnup of the fissile material can be calculated. It was necessary to establish an accurate value for the isotopic composition of "natural" molybdenum. This was measured with the mass spectrometer. Reproducibility of "burnup" measurements was measured with this method. The results obtained by this method were compared with those obtained by a number of other techniques, such as gamma spectrometry, radiochemical determination of Sr^{89}, Zr^{95}, or Cs^{137}, and also U^{235} depletion. (auth)

23628 (TID-7629(p.177-83)) THE DETERMINATION OF BURNUP IN PLUTONIUM REACTOR FUELS. J. Bubernak, J. W. T. Meadows, M. Lew, and G. M. Matlack (Los Alamos Scientific Lab., N. Mex.).

Only a few fission products are suitable for use in the determination of burnup in plutonium fuels by fission-product analysis when the history of the fuel is one of a long period of neutron exposure which was repeatedly interrupted, or characterized by a fluctuating power level, such as might be expected in prototype plutonium-fueled power reactors. Among the requirements for a suitable fission-product indicator of burnup under these conditions are long half-life, relatively high fission yield, and easily measured radioactivity. This limits the selection to Sr^{90}, Ru^{106}, Cs^{137}, Ce^{144}, Pm^{147}, and, perhaps, Tc^{99}, if the exposure periods are a few months in length. For much longer exposure periods, the group is narrowed down to Sr^{90}, Cs^{137}, and Tc^{99}. The Tc^{99} might be unsuitable as a radioactive indicator because of its very low specific activity, but might be usable if determined colorimetrically. For choosing between Sr^{90} and Cs^{137}, other considerations arise, mostly of radiochemical nature. For the problems associated with the LAMPRE program at Los Alamos, Sr^{90} analysis is indicated as the method of choice, although the selection remains tentative because of limited opportunity for testing the procedure on long, interrupted exposures. The actual analytical procedure involves Sr separation based on nitrate, chromate, and oxalate precipitation to obtain radiochemically pure Sr fission products. After a suitable waiting period, Y^{90} is separated from the Sr by tributyl phosphate extraction. The Y^{90} is then used for the actual radioactive measurement, from which the number of atoms of Sr^{90} in the sample is calculated, and thence the per cent burnup. Test analyses on fuel samples which received short exposures show good agreement with other types of burnup determinations, with a relative standard deviation of 3%. Evaluation of the method for long-term exposures, of the order of months, was not completed. (auth)

23629 (TID-7629(p.185-92)) THE DETERMINATION OF THE SPECIFIC ACTIVITY OF PILE-PRODUCED PLUTONIUM BY MEASUREMENT OF Pu^{238} CONTENT. G. M. Matlack and R. K. Zeigler (Los Alamos Scientific Lab., N. Mex.).

Control analyses by counting methods in plutonium recovery plants require a knowledge of the specific activity of each batch of plutonium processed. Many feed batches are of such a nature that the specific activity cannot be determined by a comparison of the weight of pure material with alpha activity. However, because there is a linear relationship between Pu^{238} content and specific activity, it is possible to determine the specific activity by a method based on alpha pulse-height analysis for the Pu^{238}. Samples are prepared by extracting 0.2 to 1 μg of plutonium from 1M HNO_3 into 0.5M TTA, thus removing americium, which would interfere in the subsequent pulse-height analysis. An aliquot of the TTA containing about 5000 alpha counts/min is evaporated to dryness on a micro cover glass and ignited to about 500°C to remove any residue. The fraction of Pu^{238} alpha activity in the sample is then determined by pulse-height analysis to a precision of 3%. The specific activity is calculated from the equation: counts min^{-1} (μg Pu)$^{-1}$ = 69,530 + 5040 × (% Pu^{238} alphas). The method is rapid and inexpensive, requiring approximately 20 min for sample preparation and 30 to 60 min for counting. A 3% error in the Pu^{238} determination causes a 0.4% error in the calculated specific activity. (auth)

23630 (TID-7629(p.193-208)) THE USE OF HIGH-SPEED COMPUTERS IN THE PREPARATION AND REPORTING OF ROUTINE RADIOCHEMICAL PLUTONIUM ANALYSES. P. McWilliams and G. M. Matlack (Los Alamos Scientific Lab., N. Mex.).

Three FORTRAN programs of considerable utility in calculation, preparation of final reports, and preparation of monthly summary reports were in use successfully for more than a year on IBM 704 computers and associated equipment. The first program, for routine sample calculations and reports originating with the radiochemical analysis of plutonium samples, takes as input data the sample number, customer's name, date, aliquots used, count rates found, grams of inactive salts per liter, and a code number corresponding to the type of analysis and elements analyzed for. The output consists of a printed report in duplicate, one of which is sent to the customer and the other retained by the laboratory. Direct or dilution evaporations and chemical separations of various types for americium, plutonium, and U^{233} are the usual types of analyses provided for in the program. An individually styled report is obtained for each of the different types of analyses. Machine time is about 3 min for the analysis of 60 samples; most of this is required for writing the output on tape. No transcription of data is required other than the preparation of the input data cards, thus greatly diminishing the chance for errors. The second program uses the same input data as the one above, but is designed for sorting large groups of sample data into six categories according to kind of analysis, such as plutonium by dilution, americium by straight cut, or plutonium by TTA extraction. Each category is then further subdivided into four count-rate ranges, 1 to 100, 101 to 1000, 1001 to 10,000, and 10,001 to 100,000 counts/min. The combined data in each subdivision are used to calculate the total average precision of the analyses in that subdivision, the standard deviation due to the counting error alone, and the precision due to the particular method alone. These results are printed in suitable tabular form along with the total number of samples in each subdivision. The third program performs the task of compiling a monthly table summary showing the origin of all samples, the descriptions of various types of samples, the analytical methods required within each descriptive type, the elements determined, the number of analyses performed in that particular group, the time required, and the average time per analysis. This is particularly helpful in the preparation of monthly reports designed to display the wide variety of analytical samples reported and the work required for these analyses. Numerical coding for input data was avoided by designing the program to sort on the basis of symbols for the elements, and on simple two-letter abbreviations for the sample descriptions. The program provides considerable saving in time as compared to the manual preparation of such a table, and is sufficiently flexible that sample descriptions, place of origin, and other information may be changed at input time. (auth)

23631 (TID-7629(p.209-16)) DETERMINATION OF IMPURITIES IN CESIUM-137. R. Sauvagnac (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay).

The chemical and radiochemical tests performed on $Cs_2^{137}SO_4$ are described. The following radiochemical impurities were studied: Cs^{134}; $Ru^{103}-Rh^{103}$; $Ru^{106}-Rh^{106}$; $Zr^{95}-Nb^{95}$; $Sr^{90}-Y^{90}$; and $Ce^{144}-Pr^{144}$. The only chemical impurities determined were NO_3^- and NH_4^+. The $Cs_2^{137}SO_4$ solutions used had concentrations of about 40 and 150 mc/ml, counted as Cs^{137}. The Cs^{134} content of the Cs^{137} was obtained by two methods: with a multichannel gamma spectrograph equipped with a memory, the 1.37-Mev peak was subtracted, using a standardized Cs^{134} source, and Cs^{137}

sources were prepared by the addition of different standard amounts of Cs^{134}; the curve showing the height of the 1.37-Mev peak as a function of quantity of Cs^{134} gives at the origin the concentration of the unknown. The ruthenium in the form of a complex with HCl was separated from the Cs^{137} on a cation-exchange resin. Zr^{95} and Nb^{95} were eluted from the same resin by 0.5% oxalic acid. Ce^{144} in an HNO_3 solution was extracted with TTA or hexone. Sr^{90}, after elimination of Ce^{144}, was fixed on a column of $SrSO_4$ and counted. The nitrate was measured by colorimetry with phenol disulphonic acid. The ammonia, after distillation, was determined as indophenol by spectrophotometry. The separation and counting methods used are described. All the separations were carried out in a shielded cell. (auth)

23632 (TID-7629(p.221-38)) COMPUTER-COUPLED, AUTOMATIC ACTIVATION ANALYSIS. D. Gibbons, L. E. Fite, and R. E. Wainerdi (Texas. Agricultural and Mechanical Coll., College Station).

Several digital computer programs are now available for the analysis and reduction of data obtained by gamma spectrometers. Such programs are readily adapted for use in gamma-spectrometric activation analysis where the whole procedure of calculation of experimental results can be performed on the digital computer. To take advantage of the high speed with which a digital computer can analyze gamma-spectrometric data, it is worthwhile making the accumulation of this data as automatic as possible so that large numbers of samples can be analyzed at a rapid rate. The requirements for an automatic system for activation, transport, and spectrometric analysis of analytical samples are discussed, and an approach to such a system is described. Various computer programs for use in automatic computer-coupled activation analysis are discussed and compared, and possible trends in this field are indicated. Various results obtained by this technique are presented and discussed. (auth)

23633 (TID-7629(p.239-44)) TRACE ELEMENT DETERMINATION IN NIOBIUM AND ZIRCONIUM METAL BY RADIOACTIVATION ANALYSIS. J. F. Emery, W. T. Mullins, L. C. Bate, and G. W. Leddicotte (Oak Ridge National Lab., Tenn.).

Niobium and zirconium metal were analyzed for some 20 odd elements by neutron radioactivation analysis. Niobium was analyzed for Al, Br, Cl, Co, Cr, Cu, Fe, Hf, Mn, Mo, Na, Ni, P, S, Si, Ta, Th, U, V, W, Yb, Zn, and Zr. Zirconium was analyzed for Ca, Cd, Co, Fe, Hf, Ni, Sn, and Zn. Each sample of niobium and zirconium metal was irradiated along with suitable comparators (approximately 20 mg of the element or compound of the element to be determined) in irradiation facilities. After irradiation, the analysis was completed by either a radiochemical separation or a nondestructive method. In both methods, a multichannel gamma spectrometer was used to measure the gamma radioactivity. Information is given on the limits of measurement for each of the elements determined, and the procedures used for the determination of specific elements are discussed in detail. For example, the analysis of hafnium was accomplished by irradiating niobium and zirconium in the pneumatic tube of the Oak Ridge Research Reactor for a few seconds after which the Hf^{179m} (19 sec) radioactivity was determined by a "differential count" on a multichannel gamma-ray spectrometer. (auth)

23634 (TID-7629(p.245-57)) THE DETERMINATION OF MINOR ELEMENTS IN ULTRAPURE BERYLLIUM AND ITS COMPOUNDS BY NEUTRON RADIOACTIVATION ANALYSIS. W. T. Mullins, J. F. Emery, L. C. Bate, and G. W. Leddicotte (Oak Ridge National Lab., Tenn.).

Neutron radioactivation analysis was used to determine microgram and submicrogram quantities of elemental impurities (Sc, Th, U, Mn, Au, Fe, As, Cr, etc.) in refined beryllium metal and its compounds. The test samples and standard samples containing known amounts of each element were irradiated in the air-cooled facility of the ORNL Graphite Reactor at a flux of 8×10^{11} neutrons cm^{-2} sec^{-1} for at least 62 hours. Absolute measurement techniques are not needed, since known standards are used with each irradiation and a comparison can, therefore, be made between the desired radioactivity in the standard and the same radioactivity in the unknown. By use of the Graphite Reactor facility, limits of measurement for many of these elements, ranging from 10^{-5} to 10^{-9} g, can be obtained. For example, 0.1 μg of thorium, 0.02 μg of U^{238}, 0.001 μg of U^{235}, and 0.005 μg of scandium can be determined with an accuracy and precision of the order of 5%. These limits of detection can be increased proportionally by the use of other reactor facilities having a greater neutron flux. The radioactivity for each particular radionuclide was measured by means of gamma scintillation spectrometry, either as a direct assay of the irradiated sample or following a radiochemical separation of the radionuclide from the irradiated sample. A 3 × 3 in. NaI(Tl) crystal was used as the scintillation detector, and the radioactivity data were accumulated through a multichannel pulse-height analyzer. The radioactivation methods used in these determinations are reported. Typical data obtained in analyses and the advantages and disadvantages of these methods are discussed. (auth)

23635 (TID-7629(p.259-66)) A PROGRAM FOR PUBLICATION OF AEC MEASUREMENT METHODS. R. J. Jones (Atomic Energy Commission, Washington, D. C.).

The AEC material control system, which is concerned with the quantity control of source and special nuclear material (SS material) within the AEC complex, operates in such a way that measurement differences between shippers and receivers can be allowed within reasonable limits. The main reason for this is that money does not change hands when SS materials are transferred within the AEC complex. Transfers of SS materials into or out of the AEC complex usually involve monetary payments or credits. The monetary values are based on measurement of the quantity and quality of the materials involved. Since the AEC is entering into an increasing number of such transactions, the AEC's Advisory Committee for Standard Reference Materials and Methods of Measurement recommended that the measurement methods for the major areas of interest be reviewed, evaluated, and published with some recognition of status by the AEC. Acting on this recommendation, the AEC initiated a program to publish AEC measurement methods. Implementation of the program was accomplished by means of a series of technical seminars to which were invited persons of recognized technical competence in specific fields of measurement. To make most effective use of the available experience, the seminars were divided into six sections: emission spectroscopy, mass spectrometry, radiochemistry, plutonium chemistry, uranium chemistry, and sampling. The various reactor programs were reviewed to develop a list of SS materials used and to predict measurements that would be needed for them. Through the participants in the seminars, the experience of both government and private facilities working with atomic energy materials was used to obtain measurement methods, information with which to evaluate the methods, and information on which to base recommendations for methods research and development. (auth)

23636 (TID-7629(p.276-84)) THE SPECTROGRAPHIC DETERMINATION OF TRACE IMPURITIES IN URANIUM COMPOUNDS USING REVERSED-PHASE PARTITION

CHROMATOGRAPHY. W. Fletcher, R. Franklin, and G. C. Goodall (United Kingdom Atomic Energy Authority. Development and Engineering Group, Capenhurst, Ches., England).

A technique was developed for the determination of 25 trace elements in uranium compounds. The method, which is capable of extension to other impurities, is particularly suited to the analysis of enriched uranium compounds, since all the uranium is removed prior to spectrographing. In addition, complete recovery of the uranium in a pure condition is accomplished. The method is based on the separation of uranium from the trace impurities by means of a reversed-phase chromatographic procedure. A nitric acid solution of the sample is passed through a chromatographic column containing tributyl phosphate supported on polytrifluoromonochloroethylene (Kel-F) powder. Uranium is retained on the column. Phosphoric acid is added to the eluate, which contains the trace impurities and the resultant solution is evaporated to a syrup. The syrup is diluted with nitric acid, palladium nitrate is added to provide a spectrographic internal standard, and the mixture is analyzed spectrographically, using the rotating-graphite-disc technique. The determination of trace quantities of Al, As, Ba, Bi, Cd, Co, Cr, Cu, Fe, Ga, Ge, In, La, Mg, Mn, Mo, Ni, Nb, Pb, Re, Sc, Tl, W, V, and Zn was studied. Using a sample weight of 0.5 g of uranium, limits of detection ranging from 0.5 ppm for Cd to 10 ppm for Al were obtained. Lower limits of detection can be achieved by increasing the size of sample and chromatographic column. The coefficient of variation of the method was found to vary from 4 to 7%, depending on the element concerned, at the 25-ppm level. An account of the experience gained with this method under routine conditions is included. (auth)

23637 (TID-7629(p.285-94)) THE DETERMINATION OF URANIUM IN WASTE PRODUCTS ASSOCIATED WITH ZIRCONIUM–URANIUM FUEL ELEMENT PRODUCTION. R. Farnsworth and J. Meakin (Rolls-Royce Ltd., Derby, England).

The determination of uranium in plant effluent, HNO_3–HF pickling solution, incinerator ash, dusts from air-extraction filters, and in pig iron and slag produced from Tinamel (a mild steel used for jacketing Zr–U fuel alloy) is discussed. Analysis of these materials was necessary for health-physics, accountability, and recovery purposes. Two methods of extraction and determination of the uranium are utilized. Using these two methods, it is possible by concentration or dilution of the sample to analyze for a wide range of uranium concentrations. A fluorimetric method for uranium in concentrations of less than 100 ppm is used for effluent, air-filter, pig-iron, and slag analysis. A solution of the sample in HNO_3 containing approximately 1.5 μg uranium per ml is made not more than 5N to HNO_3, and 2.5N in $Al(NO_3)_3$. Uranium is extracted as tetrapropyl ammonium uranyl tri-nitrate with methyl isobutyl ketone, and determined on a fluorimeter. Accuracy is within 10% for less than 1 ppm of uranium. Effluent solutions are evaporated to dryness, organic matter (detergents, etc.) is destroyed with HNO_3, and the uranium is extracted and determined. Filter dusts are dissolved in HF/HNO_3, filtered, evaporated to dryness to remove HF, and taken up in HNO_3. Pig iron is dissolved in HNO_3, and filtered to remove silica and graphite. Slags are dissolved in dilute HCl; silica is precipitated by evaporation with HCl and filtered off, after which the filtrate is evaporated to dryness and taken up in HNO_3. A method for uranium concentrations greater than 100 ppm is used for pickling solution and incinerator ash. Uranium (not more than 8 mg) is extracted by reverse-phase partition chromatography between 5.5M HNO_3 and tributyl phosphate. Uranium is held in the static TBP phase, which is supported in the column on powder. Impurities are eluted by washing with 5.5M HNO_3. Uranium is recovered by eluting with water, and is determined absorptiometrically as the thioglycollate complex in the presence of EDTA. Accuracy is ± 5% for uranium content of 2 g per liter of solution. In the analysis of HNO_3–HF pickling solution, 5 ml is used for up to 1.5 g of uranium per liter, 2 ml for 1.5 to 3.5 g of uranium per liter. After evaporating the solution to dryness, the residue is dissolved in 5.5M HNO_3 and the solution is then transferred to the chromatographic column. In the analysis of incinerator ash, for up to 0.8% uranium, 1 g is fused with Na_2CO_3, extracted in dilute HNO_3, filtered and transferred to the chromatograph column. (auth)

23638 (TID-7629(p.295-307)) DETERMINATION OF OXIDES AND NITRIDES IN SALTS AND METALS BY HIGH-TEMPERATURE FLUORINATION WITH POTASSIUM BROMOTETRAFLUORIDE. G. Goldberg (Oak Ridge National Lab., Tenn.).

A method is described for the determination of oxides and nitrides in salts, as well as in metals, by high-temperature fluorination. The fluorinating agent, $KBrF_4$, which is prepared in a nickel reactor by the addition of BrF_3 to KF, is reacted with the oxides or nitrides for 2 hours at 450°C to produce elemental oxygen or nitrogen, which is then measured tensimetrically. Provision is also made to measure both gases in the presence of each other. The apparatus which is described is so designed as to permit the analysis of some 20 to 30 samples per batch of $KBrF_4$. A measuring manometer calibration apparatus and an automatic Toepler pump controller are also described. Recovery of oxygen from pure metal oxides as standards is better than 98% with a coefficient of variation of less than 5%. The precision obtained in the analysis of fluoride salts is better than 10%. The range of oxygen or nitrogen that can be measured is from 0.01 to 10 mg. (auth)

23639 (TID-7629(p.316-27)) HYDROGEN IN URANIUM METAL. F. E. Jenkins and T. J. Keefe (National Lead Co. of Ohio, Cincinnati).

The hydrogen concentration in uranium metal was determined at successive processing steps at the National Lead Company of Ohio. Factors that influence the ultimate concentration in finished fuel cores were evaluated, and methods that may be utilized to assure low hydrogen levels are reported. Metal charged into the vacuum remelt furnace has a relatively high concentration of hydrogen. The ingot casting process, however, markedly reduces the hydrogen. The salt bath preceding the rolling operation may add or remove hydrogen from the ingot, but the concentration in the subsurface of the rolled metal is not substantially changed in subsequent processing steps. Hydrogen is added to the surface of uranium core blanks in the beta-heat-treating salt baths, but a major part of this hydrogen is removed in the next machining operation. The average hydrogen level in the finished core is 1.7 ppm, with surface hydrogen determined to be 2 to 4 ppm. By control of charge material, furnace pressure, and atmospheric environment of the salt baths, fuel elements were produced which are low in hydrogen. Beta heat treatment by magnetic induction adds insignificant amounts of hydrogen to the surface of cores. Core blanks or finished cores were successfully outgassed on a small scale. (auth)

23640 (TID-7629(p.331-44)) EVALUATION OF THE PERKIN-ELMER-SHELL SORPTOMETER FOR MEASUREMENT OF LOW-SURFACE-AREA URANIUM COMPOUNDS. W. Burkhardt, K. J. Notz, and C. W. Huntington (National Lead Co. of Ohio, Cincinnati).

A sorptometer, for measurement of surface area of solid

samples, was evaluated. Although this instrument was developed primarily for the examination of catalysts with high surface area, it was successfully applied to uranium compounds of low surface area through modifications in technique and equipment. The principle of operation is based on the theory of Brunauer, Emmett, and Teller (BET). Measurements, however, are made using a continuous flow of gas rather than a static system. Nitrogen is adsorbed by the sample from a flowing nitrogen–helium gas mixture at the temperature of liquid nitrogen, and then desorbed as the sample is warmed to room temperature. The change in thermal conductivity is measured with a detector similar to that used in gas chromatography. The difference in thermal conductivity during adsorption and desorption is recorded on a chart as two peaks. The area of the peaks is proportional to the volume of nitrogen involved. Advantages of this instrument are: use of an abbreviated solution to the BET equation whereby it is possible to obtain surface-area data in one-third the time necessary for the conventional static method and trouble-free operation, since there is a minimum of glass and no high-vacuum system. (auth)

23641 (TID-7629(p.345-56)) ROUTINE AUTOMATIC NITROGEN ABSORPTION-DESORPTION MEASUREMENTS. P. G. Dake, E. A. Woy, and H. A. Kermicle (Oak Ridge Gaseous Diffusion Plant, Tenn.).

The method of Ballou and Doolen, in which small calibrated quantities of nitrogen gas are repeatedly added to or removed from a sample system, was further developed and adapted to routine measurements of adsorption and desorption over the range of partial pressures from 0 to 1 (referred to the vapor pressure of liquid nitrogen). By converting from manual to automatic measurements, the time required per sample was reduced from over 40 to 8 hours and the reliability of the data was much improved. The elapsed time per measurement varies with the sample size and pore structure; three samples will ordinarily be completed per week. The principal modifications made in the Ballou and Doolen method are as follows: the pressure was measured automatically by mercury manometers described by Farquharson, pressure transmitters were substituted for mercury contact assemblies as helium and nitrogen dosers to provide more reproducible gas volumes, and the apparatus was enclosed in a constant-temperature cabinet. Constant-volume measurements were thus assured and the calculations were simplified. The recorded data were used to calculate surface area and pore-volume distribution of the sample, using an IBM 7090 computer. The well-defined distributions of pore volume resulting from the use of this system of measurements permit refined studies of structure of sample materials. A study by another group, using these measurements, is now under way on the relationship of preparation, treatment, and reactor exposure to the structure of various types of thoria. (auth)

23642 (UCLA-504) A RAPID METHOD FOR DETERMINING TRITIUM WATER IN URINE FOLLOWING ACUTE EXPOSURE. L. S. Myers, Jr. and Cynthia Rosenblum (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). May 1962. Contract AT(04-1)-Gen-12. 14p.

HTO in the urine of exposed individuals was determined within minutes after receipt of samples by a detergent-anthracene-scintillation counting method. The procedure consists merely of pipetting an aliquot of the sample onto detergent coated anthracene in a counting vial and counting in a liquid scintillation counter. Reproducibility, stability, and sensitivity are adequate to give reliable results with tritium concentrations well below the maximum permissible level of 28 μc/l. Yellow pigments decrease the counting efficiency according to Beer's law, and must be removed if a highly accurate analysis is required. However, for most bioassay purposes a correction based on an optical density measurement will give satisfactory results. (auth)

23643 (AEC-tr-5116) RADIO-ACTIVATION ANALYSIS IN THE SERVICE OF INDUSTRY. P. Leveque. Translated by Myra S. Feldman (Savannah River Lab., Aiken, S. C.) from Pure and Appl. Chem., No. 1, 53-60(1960). 5p.

Also issued in the original as reprint CEA-1774.

The use of activation analysis in industry is discussed and compared with other methods of analysis. The uses of the reactions of radiation with materials as a means of analysis are described including absorption, diffusion, and excitation methods. (M.C.G.)

23644 A NEW SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF URANIUM(VI). David Dyrssen and Solveig Ekberg (Royal Inst. of Tech., Stockholm). Acta Chem. Scand., 16: 785-7(1962). (In English)

It was found that a solution containing uranium(VI), β-isopropyltropolone, and pyridine has a light absorbance at 405 mμ proportional to the uranium(VI) concentration and independent of the solvent composition. This method can be used to determine uranium(VI) concentrations $\geq 10^{-4}$ M with 1-cm cells, and its sensitivity is twice that of the thiocyanate and cyanoferrate methods. (D.L.C.)

23645 AN IMPROVED TITRIMETRIC METHOD FOR GALLIUM AND FOR GALLIUM IN THE PRESENCE OF ALUMINUM. Jack E. Mee and John D. Corbett (Ames Lab., Ames, Iowa). Chemist Analyst, 50: (Sept. 1961). (IS-163)

The determination of gallium by the Cu-PAN method was found to be improved by lowering the pH to 1.6 to 2.0. This resulted in a rapid and accurate titration with a 100.0 ± 0.4% recovery at the 95% confidence level. For gallium in the presence of aluminum, an amount of KF one to two times that necessary to form AlF_6^{3-} was added prior to the addition of buffer. The recovery was 99.9 ± 0.8% at the 95% confidence level. Data are tabulated. (P.C.H.)

23646 A STUDY OF THE SLOW NEUTRON ACTIVATION ANALYSIS OF CERTAIN ARSENIC AND ANTIMONY CONTAINING PHARMACEUTICALS. David Gilbert Kaiser (Purdue Univ., Lafayette, Ind.). Dissertation Abstr., 22: 3616-17(Apr. 1962).

A study was initiated to investigate the application of slow neutron activation to pharmaceutical analyses. Arsenic and antimony were selected as the representative elements for the investigation. The procedure essentially involved three steps: (1) bombardment of the sample; (2) preparation of the sample for counting; and (3) the counting procedure. Neutron bombardments were conducted at the Argonne National Laboratory CP-5 Reactor, and the induced radioactivity was detected with a gamma-ray scintillation spectrometer. The instrument contained a single channel pulse height analyzer and a well-type thallium-activated sodium iodide crystal. Polyethylene irradiation containers were constructed for the activation of hygroscopic samples, and quartz tubing was utilized for biological materials. The method was applied to the analysis of five pharmaceuticals: (1) Antimony Potassium Tartrate, (2) Arsenic Trioxide, (3) Carbarsone, (4) Oxophenarsine Hydrochloride, and (5) Stibophen. An average analytical error of four to five per cent was obtained. Irradiations were performed at a neutron flux of $\sim 10^{8}$ to emphasize the possibilities of laboratory sources for routine analyses. Twenty-four to forty-eight hour irradiation exposures resulted in milligram sensitivities for these

pharmaceuticals. The procedures were conducted without a chemical separation; however, interference from beta emitting isotopes was found to occur. Shielding studies were undertaken to eliminate the interfering beta radiation found in activated tissue samples. Lucite, aluminum, steel, and lead radiation shields were constructed to enclose the sample within the well-type sodium iodide crystal. Investigations conducted with phosphorus-32 and sulfur-35 indicated that energetic beta emitting isotopes caused the formation of bremsstrahlung when shielded. This radiation was detected by the scintillation spectrometer. For the analysis of biological systems, in neutron fluxes of $\sim 10^{12}$, an irradiation time of twenty-four hours was found to be preferable. The determination of arsenic content in rat kidneys, following intravenous Oxophenarsine Hydrochloride therapy, was performed in conjunction with an aluminum irradiation shield. The method had a microgram limit of sensitivity for arsenic. If greater than microgram sensitivity were desired, a longer irradiation time and a chemical separation would be required.

23647 THE DETERMINATION OF POTASSIUM BY THE RADIOCHEMICAL METHOD. Wen-cheng Hu, Ch'en-ch'üan Lin, and Shih-tse Chang. Hua Hsüeh Hsüeh Pao, 26: 39-40(Feb. 1960).

A simple and more efficient method for determining K quantitatively by means of K^{40} is described. A potassium salt sample is placed in an inner tube with a minimum inside diam of 4.2 cm (the sample thickness must be >1.21 cm) and a movable cover. A constant voltage is maintained with two STS-6 counting tubes fixed vertically on an organic glass rack. Then the pulse rate is measured after the tubes are connected in parallel in a Pb chamber. The average pulse rate induced by 1% K salt was 54.6 pulses/min, while a rate of 28 pulses/min was obtained with one counting tube. Tabulated analytical results thus obtained for a number of fertilizers deviated less than 1% from those results obtained by chemical analysis. (OID)

23648 TOOLS FOR ANALYTICAL CHEMISTRY. Theodore Melnechuk. Intern. Sci. and Technol., No. 8, 14-25(Aug. 1962).

A review is given of new methods in analytical chemistry with special attention to wet methods. Brief descriptions of major methods in the three professions, electroanalysts, spectroscopists, and resonance specialists, are given. A comparison is made of 15 important methods in analytical chemistry according to the form of energy used. Mention is also made of radioactivity for analysis and trends in analysis. (P.C.H.)

23649 THE RANGES OF APPLICATION OF ACTIVATION ANALYSIS. S. Niese. Isotopentechnik, 1: 165-6 (May 1961).

Neutron bombardment of target materials is often used to activate samples for the preparation of radioisotopes and to determine traces of impurities in the substances. The method is explained for these examples: trace determination in P^{32}; determination of the amount of rare earth elements in substances, i.e., Ir in Pt, Co in Fe, and of Co in iron; and activation analysis of insulating materials. (OID)

23650 CHROMATOGRAPHY ON PAPER IMPREGNATED WITH INORGANIC ION EXCHANGERS. III. CHROMATOGRAPHY OF INORGANIC IONS ON ZIRCONIUM PHOSPHATE PAPER WITH HCl, H_2SO_4, HNO_3, $HClO_4$ AND CH_3COOH AT VARIOUS CONCENTRATIONS. Giulio Alberti, Franco Dobici, and Giuliana Grassini (Istituto di Chimica Generale, Università, Rome and Laboratorio di Chimica delle Radiazionie Chimica Nucleare del C.N.E.N., Rome). J. Chromatog., 8: 103-7(May 1962). (In English)

The chromatographic behavior of a large number of inorganic ions on zirconium phosphate paper is described. Inorganic acids, such as HCl, HNO_3, H_2SO_4, and $HClO_4$, at concentrations ranging from 0.1 to 6 N were used as eluents. The application of the equation $XpH = R_M + const.$ for papers impregnated with weak ion exchangers or ZP-impregnated papers is discussed. (auth)

23651 QUANTITATIVE DETERMINATION OF URANIUM AND THORIUM IN ROCKS. T. W. Bloxam (University of Wales, University Coll. of Swansea, Singleton Park, Swansea, Eng.). J. Sci. Instr., 39: 387-9(July 1962).

Uranium and thorium in the parts per million range may be determined quantitatively by counting their gamma emission at 1.76 Mev and 2.62 Mev respectively. The method has been applied to natural radioactivity in silicate rock powders and other geological materials. The sensitivity and precision have been considerably increased by sample holders designed to improve the geometry of the sample in relation to the analyzing crystal. (auth)

23652 DIFFERENTIAL THERMAL ANALYSIS OF U_3O_8 AND OF MIXTURES OF U_3O_8 WITH Mg, Zr, and Be OXIDES. Pavel Imriš. Jaderná energie, 8: 126(1962). (In Czechoslovakian)

A differential thermal analysis (DTA) of U_3O_8 at 1100 to 1500°C and of the mixture of U_3O_8 with MgO in the proportion 1Mg : 1U, 2Mg : 1U, 3Mg : 1U, and 1Mg : 3U is described. A DTA of a mixture of U_3O_8 with ZrO_2 in the proportion 1Zr : 1U and of a mixture of U_3O_8 with BeO in the proportion 1Be : 1U is also described. (auth)

23653 SOME DATA ON THE ANALYSIS OF URANIUM, THORIUM, AND ZIRCONIUM. Gyula Almássy, Mária Oerdoegh, and Anna Schneer. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 291-304 (July-Aug. 1958). (In Hungarian)

Considering the physicochemical conditions for tributyl phosphate (TBP) uranium extraction, an optimum nitrate concentration of the aqueous phase is found, in which uranium separation by single extraction amounts virtually to 100%. The extraction is carried out in TBP-petrol solution and the uranium is re-extracted in a dilute ammonium carbonate solution. The uranium content can be determined by the morin method, or by reduction of U(VI) to U(IV) and subsequent oxidizing with Fe(III), which can be measured by the light absorption of α-α dipyridyl complex equivalent to uranium (at 500 mμ wavelength). In the chromatography of thorium, it is found that using a particular solvent, thorium produces an elongated strip on a cellulose column or on paper. This strip becomes more compact with increasing acid and water content of the solvent. The optimum composition of the solvent is determined: 8N nitric acid is shaken with the same quantity of ether and after separation of the two phases the ether phase is used. Among the colorimetric determinations of thorium, the thoron method is improved for the analysis of ores by reducing Fe(III) in ascorbic acid. The sensitivity of the method increases by about 70% by the addition of methylalcohol. Zirconium and hafnium, which can be separated selectively with mandelic acid, can be determined as follows: the precipitate, containing 0.2 to 5 mg zirconium, is dissolved in excess concentrated sulfuric acid, and the mandelic acid bound to the zirconium is quantitatively oxidized into carbon dioxide and water with sodium bichromate solution. In the presence of 2 to 20 mg zirconium the oxidation can be carried out with excess $KMnO_4$ in a strong alkaline medium. In this case the mandelic acid oxidizes into benzoic acid. The vivid yellow

zirconium morin complex fluorescing in UV light is suitable for the photometric determination of 0.1 to 30 μg zirconium. Measurements can be carried out between 420 and 470 mμ. (auth)

23654 SEPARATION OF STRONTIUM FROM MILK AND PROTEIN SOLUTIONS BY GEL FILTRATION. W. H. S. George (University of Birmingham, Eng.). Nature, 195: 155-7(July 14, 1962).

A method is described for the detection of strontium in both skim and whole milk samples by gel filtration on Sephadex. Unskimmed milk has a viscosity too high for it to be eluted, so it was necessary to skim the milk prior to elution from a column. Phosphate saline buffer was used to avoid precipitation of protein on the column by variation in pH or ionic strength. When strontium was added to whole milk and then centrifuged, it could only be detected in the skimmed milk and not in the fat. Strontium was determined by the addition of p-dimethyl amino-benzylidene rhodanine on the gel particles, which turned rose pink. Discussion is given on the importance and advantages of this method for the removal of strontium from milk. (P.C.H.)

23655 X-RAY SPECTROMETRIC DETERMINATION OF ZIRCONIUM IN REFINED URANIUM MATERIALS. G. R. Blank and H. A. Heller (National Lead Co. of Ohio, Cincinnati). Norelco Reptr., 9: 23-7(Jan.-Feb. 1962).

A method is presented for the x-ray spectrometric determination of zirconium in uranium metal and other refined uranium materials. After a chemical separation of the zirconium from uranium with a 2-thenoyltrifluoroacetone (TTA) extraction, the zirconium is determined in the organic (TTA) phase. Determinations of zirconium in the range from 5 to 100 ppm are derived from the ratio of ZrKα to background intensities. The actual limit of detection in 2 μg Zr/ml in the organic solution. The limit of error for a single determination at the 95 per cent confidence level has been found to be ± 1.7 ppm zirconium in the range from 5 to 100 ppm Zr (corresponding to ± 0.7 μg Zr/ml in the range from 2 to 40 μg Zr/ml). One experienced operator can prepare and analyze fourteen samples in an eight-hour day. (auth)

23656 RADIOLOGICAL POTASSIUM DETERMINATION IN GLASSES. Karl Barth. Silikat Tech., 11: 554-8(Dec. 1960).

The K content of all substances can now be determined automatically and with great accuracy because of the presence of the natural isotope, K^{40}, in all K-containing raw materials and manufactured goods, such as glass. K^{40} decays to 80% under electron emission to Ca^{40} and to 11% under electron capture to Ar^{40} which emits γ rays. Since natural K contains 0.011% of the radioisotope, K^{40}, the specific β activity of 1 g natural K can be calculated from the half life and atomic weight of its active component as 1.6×10^3 β disintegration/g/min. In order to measure activities so small a flask counter is used in which the K content of a KNO_3 solution can be determined with greater accuracy than in solid samples and other types of detectors. Since the K_2O content of the ordinary glasses is less than 12%, a mean counting rate of 100 pulse/min would be subject to an error of ±1 pulse/min corresponding to 0.1% K_2O. The measurements become more exact, the longer the counting is carried out. The counting of 180 min would give an accuracy comparable to that of a good chemical analysis. As the counting period is extended beyond 180 min, for instance, to 1000 min, the result of the K determination becomes very exact for all practical purposes and its reproducibility surpasses that of chemical determinations. (OID)

23657 DETERMINATION OF SCANDIUM BY PROPYLPHLUORONE. V. A. Nazarenko and E. A. Biryuk (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Zavodskaya Lab., 27: 401-6(1962). (In Russian)

A photometric method for determining 0.0002% Sc in a 1-g specimen of rock or technical products (silicates, tungstates, zirconates, coal ash, slag, etc.) is described. The interfering admixtures Th, Zr, and Al are masked in the presence of ascorbic acid by acetylacetone and Fe by orthophenanthroline. (R.V.J.)

23658 SEPARATION OF SMALL QUANTITIES OF CERIUM FROM BASIC COMPONENTS OF CHROMIUM–NICKEL. E. K. Korchemnaya, D. I. Ryabchikov, and V. I. Naumova (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zavodskaya Lab., 28: 539-40(1962). (In Russian)

The separation of milli- and microgram quantities of Ce from Ni–Cr was achieved by separating Ni with hydrochloric acid, separating Cr electrolytically, and precipitating Ce as hydroxide or fluoride with neodymium carrier. (R.V.J.)

23659 DETERMINATION OF Nb BY DIFFERENTIAL SPECTROPHOTOMETRIC METHOD. T. M. Malyutina, E. L. Futoryanskaya, and F. A. Vinokurova (State Scientific Research and Planning Inst. of Rare Earth Industry, USSR). Zavodskaya Lab., 28: 540-2(1962). (In Russian)

The spectrophotometric determination of niobium, based on measuring the yellow component by thiocyanic acid formed in homogeneous hydrous acetone medium, is described. Technical pentavalent Nb, potassium fluoroniobate, and barium and potassium niobates were analyzed. The results are in good agreement with gravimetric methods; maximum deviation does not exceed 0.5 to 1%. (R.V.J.)

23660 GRAVIMETRIC DETERMINATION OF ZIRCONIUM WITH PHENYL-PHOSPHONIC ACID. I. P. Alimarin and V. I. Fadeeva (Lomonosov Moscow State Univ.). Zhur. Anal. Khim., 17: 385-7(May–June 1962). (In Russian)

Gravimetric determination of zirconium by precipitation with phenyl-phosphoric acid as $ZrO(C_6H_5PO_3H)_2 \cdot 2H_2O$ is suggested. The precipitate is ignited at 900 to 1000° to ZrP_2O_7. The quantity of zirconium is found by multiplying the precipitate weight by the empirical factor 0.321. The method was used for the determination of zirconium in titanium-containing alloys. (auth)

23661 ISOTOPENANALYSE DES WASSERS. (Isotopic Analysis of Waters). A. I. Schatenstein, E. A. Jakowlewa, E. N. Swjaginzewa, Ja. M. Warschawski, E. A. Israilewitsch, and N. M. Dychno. Physikalisch-Chemische Trenn- und Messmethoden. Band 4. Berlin, VEB Deutscher Verlag der Wissenschaften, 1960. 270p.

Isotopic analysis of water for D_2O and H_2O^{18} is discussed. Topics covered include: relative abundance of the isotopes of natural water, the purification of water for isotope analysis, determination of the relative abundance of the heavy isotopes of hydrogen and oxygen by the density of the water, pycnometer method for density measurement, falling drop method for determination of density, the flotation method for density measurements, determination of the relative abundance of deuterium by measurement of the refractive index, determination of the isotopic composition of oxygen in heavy water, preparation of the glass apparatus for the analysis, purification of the water samples for isotopic analysis, thermostat development, the pycnometric method, the falling drop method, the flotation method, flotation method with increased accuracy, separate determination of

the relative abundance of deuterium and the heavy isotope of oxygen in water, and measurement of the refractive index difference with an interferometer. (M.C.G.)

General Inorganic and Physical Chemistry

Refer also to abstract 24461.

23662 (AE-76) ON THE ELECTRONIC STRUCTURE OF MnB. N. Lundquist (Aktiebolaget Atomenergi, Stockholm). June 1962. 19p.

The monoborides of Mn, Fe, and Co are ferromagnetic and the saturation magnetization indicates that the numbers of 3d electrons are 8.1, 8.9, and 9.7, respectively. A three band model described by MB $2sp^{\alpha}3d^{4}4s^{\gamma}$, where 2sp implies hybridized 2s, 2p states, was proposed for these borides. Covalent 2sp bonding is discussed and the requirement of unsaturated covalency implies empty 2sp levels at the Fermi surface. These levels can receive scattered conduction electrons and may cause the electrical properties to differ from those of the pure transition metals. Expressions are derived relating the resistivity in the neighborhood of the Curie temperature to the density of electronic states and the results are applied to Ni and MnB. Unfortunately the matrix elements for the scattering transitions and the 3d band form are unknown factors. It seems, however, necessary to postulate a high density of 2sp states to explain experimental data. (auth)

23663 (ANL-6546) CHLORINATION OF URANIUM AND FISSION PRODUCT OXIDES IN MOLTEN HALIDE MEDIA. J. P. LaPlante, D. A. Wenz, and R. K. Steunenberg (Argonne National Lab., Ill.). May 1962. Contract W-31-109-eng-38. 10p.

The chlorination of mixtures of uranium and fission product oxides in various molten halide systems by sparging with a chlorine–carbon monoxide mixture was investigated. The chlorination reaction causes the suspended oxide to form species that are soluble in the molten salt and removes some of the fission product elements by volatilization of the chlorides. The rate of oxide dissolution and the fission product behavior both proved to be dependent upon the composition of the molten halide medium used. (auth)

23664 (ASD-TR-61-625) THERMODYNAMIC DATA ON OXYGEN AND NITROGEN. Jerome Brewer (Air Products, Inc., Allentown, Penna.). Sept. 1961. Contract AF33(616)-6287. 151p.

The following data, which were compiled from published literature, are presented graphically as a function of temperature and pressure: viscosity of nitrogen, viscosity of air, viscosity of saturated liquid (oxygen, nitrogen, and mixtures), vapor-liquid equilibrium ratios in oxygen-nitrogen system, dew points in oxygen-nitrogen systems, bubble points in oxygen-nitrogen system, thermal conductivity of nitrogen, thermal conductivity of oxygen, thermal conductivity of saturated liquefied nitrogen and oxygen, density of oxygen, density of nitrogen, Prandtl number of nitrogen, and Prandtl number of oxygen. For each of these properties a discussion of their critical evaluation was made. Two complete sets of curves are presented, one with experimental and correlative data points and one without data points. A complete bibliography is included. Tables of tabulated values of the properties used to construct the various graphs are presented. (auth)

23665 (BLG/B-2) BIBLIOGRAPHIE: IODE-132 (1939–1961). (Bibliography: Iodine-132 (1939–1961)). R. Stiennon-Bovy (Brussels. Centre d'Etude de l'Energie Nucléaire). Jan. 1962. 21p.

This bibliography, based on Nuclear Science Abstracts and Chemical Abstracts, contains 121 references on nuclear characteristics, chemical properties and analyses, production, medical applications and dosimetry, miscellaneous applications, presence in radioactive fallout, and miscellaneous information of iodine-132. An author index is included. (auth)

23666 (BLG/B-3) BIBLIOGRAPHIE: IODE-133 (1939–1961). (Bibliography: Iodine-133 (1939–1961)). R. Stiennon-Bovy (Brussels. Centre d'Etude de l'Energie Nucléaire). Jan. 1962. 12p.

Sixty-three references on the nuclear characteristics, chemical analyses, production, medical applications and dosimetry, presence in radioactive fall-out, and miscellaneous applications of I^{133} are given to U. S. and foreign journals and reports published from 1939 to 1961. A separate author index is included. (P.C.H.)

23667 (IA-728) RELATIVE VOLATILITIES OF THE SYSTEM H_2O^{17}/H_2O^{16}. J. L. Borowitz (Israel. Atomic Energy Commission, Tel-Aviv). Mar. 1962. 14p.

The relative volatility of the system H_2O^{17}/H_2O^{16} was determined at absolute pressures of 100 and 260 mm Hg. The experiments were carried out in a distillation column with production. (auth)

23668 (IDO-16769) PROPANE VIBRATIONAL ANALYSIS. G. D. Marshall (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). June 12, 1962. Contract AT(10-1)-205. 44p.

Using the group vibration method of McMurry, the normal frequencies and coordinates of propane and three of its symmetrical deuterium substituted compounds were obtained. The force constants used were taken from a variety of previous works on hydrocarbons. The results give reasonable agreements with the experimental frequency and mode assignments of others. (auth)

23669 (NP-11826) STUDIES IN REVERSAL AUTORADIOGRAPHY. J. Sisefsky (Sweden. Försvarets Forskningsanstalt, Stockholm). Nov. 1961. 27p.

When an autoradiograph is made with permanent contact between the photographical emulsion and the specimen, the active areas can be completely hidden by the image, if they are very small. This is overcome by a reversal-development process leaving the active parts indicated by clear zones against a colored transparent background. The sizes of these zones are measures of the activities. The different processes involved in this method are discussed and results are shown in respect to different photographical materials. (auth)

23670 (NP-11888) MEASUREMENT OF THERMAL PROPERTIES OF LiH AND LiH–Li MIXTURES: ENTHALPY, HEAT OF FUSION, CONDUCTIVITY. Topical Report. J. W. Vogt (Tapco. Div. of Thompson Ramo Wooldridge Inc., Cleveland). Oct. 15, 1961. Contract NAS 5-462. 85p. (ER-4809)

Measurements of the enthalpies of LiH and of LiH–Li mixtures in the molar proportions 90 : 10, 80 : 20, and 70 : 30 were made over the temperature range of 600–800°C. The specific heat of solid and molten material and the heat of fusion were derived from the data. Thermal conductivity was measured for molten LiH and solid LiH at the melting point. (auth)

23671 (NRL-5775) ELECTRODE PROCESSES—A SURVEY, 1956–1961. S. Schuldiner (Naval Research Lab., Washington, D. C.). Mar. 22, 1962. 48p.

The fundamental mechanisms of electrode processes

were under intensive study by many investigators in the period from 1956 to 1961. This review shall be limited primarily to recent experimental techniques for measuring electrode processes, to kinetic theories of electrochemical reaction mechanisms, and to some aspects of the electrolytic hydrogen reaction. This reaction demonstrates the complexity of even a simple and relatively easily controlled reaction. (auth)

23672 (PAN-287/IV) KINETIKA KATODNOGO PROTSESSA DLYA VYDELENIYA TORIYA IZ RASPLAVENNYKH SOLEI. CHAST III. ELEKTRONNAYA PROVODIMOST TOKO RASPLAVLENNYMI SOLYAMI. (Kinetics of Cathode Processes for Separation of Thorium from Molten Salts. Part III. Electronic Conduction Through the Molten Salt). Valim Rafal'ski and Stefan Mints (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Dec. 1961. 14p.

Electronic and ionic-electronic conductivities of molten salts composed of CaF_2, ThF_4, and ZnF_2 are investigated at 1100°C. (N.W.R.)

23673 (AEC-tr-5008) THE SEPARATION OF METALLIC ELEMENTS BY ANION EXCHANGE RESINS. II. FRONTAL ANALYSIS AND DISPLACEMENT DEVELOPMENT OF ZINC AND CADMIUM CHLORIDES. Bernard Trémillon (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Translated from report CEA-1943. 1961. 14p.

Also published in Bull. soc. chim. France, p.281-6(1961).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 27611.

23674 (AEC-tr-5178) THE DIFFUSION OF Xe^{133}, Rn^{222} AND I^{131} IN THORIUM OXIDE. HJ. Matzke and R. Lindner. Translated for Oak Ridge National Lab., Tenn. from Z. Naturforsch., 15a: 647-8(1960). 4p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 24615.

23675 (HW-tr-40) CHEMICAL AND ELECTROCHEMICAL PROPERTIES IN THE MOLTEN LITHIUM CHLORIDE–POTASSIUM CHLORIDE EUTECTIC (thesis). Guy Delarue (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Translated by Liz Appleby (Hanford Atomic Products Operation, Richland, Wash.) from report CEA-1847. 1961. 92p.

Submitted to Univ. of Paris.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 26011.

23676 A TETRAGONAL FORM OF ZIRCONIUM OXIDE SULFIDE, ZrOS. F. Jellinek (Univ. of Groningen, Netherlands and Univ. of Uppsala). Acta Chem. Scand., 16: 791-2 (1962). (In English)

The results of Schonberg reporting a tetragonal ZrS were examined, and it is concluded that this tetragonal phase was in reality ZrOS. The tetragonal ZrOS probably has a unit cell containing two formula units and a structure of the Pb PbFCl type. The observed intensities agreed well with those calculated from the parameters $Z_{Zr} = 0.195$ and $Z_S = 0.630$. (D.L.C.)

23677 HIGH TEMPERATURE CHEMISTRY. Paul W. Gilles (Kansas Univ., Lawrence). Ann. Rev. Phys. Chem., 12: 355-81(Sept. 1961).

A review is given on developments in the field of high-temperature chemistry during the past two years. Publications and conferences, theory, temperature measurement, techniques and apparatus, and experimental studies principally in the area of vaporization processes are discussed. 283 references are included. (P.C.H.)

23678 THE CARBOXY REACTIVITY AND OXYREACTIVITY OF SOME NUCLEAR GRAPHITES. Michel Jacquet and Henri Guérin (Laboratoire de Chimie M.P.C. Centre, Orsay, France and Faculté des Sciences, Paris). Bull. Soc. chim. France, 3: 411-18(Mar. 1962). (In French)

After a determination of the minimum gasification temperatures of nuclear graphite samples by oxygen and carbon dioxide, an attempt was made by tests comparable to those made on cokes to interpret the differences in reactivity among the samples. (tr-auth)

23679 PREPARATION OF URANIUM(IV) FLUORIDE BY REACTION OF URANIUM(VI) OXIDE WITH DICHLORODIFLUOROMETHANE. L. Neumann, S. Podešva, and J. Navrátil (Technische Hochschule fur Chemie, Prague). Collection Czechoslov. Chem. Communs., 27: 477-85(Feb. 1962). (In Czech)

The optimum conditions for the preparation of UF_4 from the reaction of UO_3 and CCl_2F_2 so that the UF_4 would have the lowest possible chloride contamination were determined. A new interpretation of the reaction mechanism is proposed. (J.S.R.)

23680 SELECTED HETEROPOLY COMPOUNDS OF TITANIUM AND NIOBIUM. John Carl Guyon (Purdue Univ., Lafayette, Ind.). Dissertation Abstr., 22: 3364 (Apr. 1962).

The literature on heteropoly compounds containing titanium is contradictory. The compounds have never been isolated as solids, and only one reference to an analytically useful species has been reported. Since these compounds appeared to have possible analytical utility, a spectrophotometric investigation of the complex between molybdenum and titanium was undertaken. A study of this system demonstrated that a complex acid did form between molybdenum and titanium in the pH range 3.75 to 4.2. In the presence of a large excess of the molybdate reagent, after suitable reduction, a blue hue formed which was shown to be sensitive to the titanium concentration in the concentration range investigated. The molybdotitanate species was approached from two directions. By application of statistical principles, a regression equation was developed by means of which it was possible to calculate the concentration of titanium from the measured absorbance and the concentration of the other reagents. A second, more empirical approach involved study and optimization of the variables in the system. Some conclusions as to the utility of applying the method of continuous variations and the mole ratio technique to heteropoly compounds were drawn. The relationship between certain mixed and simple heteropoly acids was investigated. A mixed acid of molybdenum, phosphorus, and niobium had been used to estimate niobium. It was decided to investigate the possible analytical utility of a simple heteropoly acid containing molybdenum and niobium. It was shown that a complex acid did form between molybdenum and niobium in the pH range 1.2 to 1.6. In the presence of a large excess of the molybdate reagent, and after suitable reduction, a blue hue was formed which was sensitive to the niobium concentration in the concentration range investigated. The method was shown to be accurate and rapid in the absence of interfering ions.

23681 ACID HYDROLYSIS AND ISOTOPIC EXCHANGE OF THE CHLORIDE LIGANDS FOR TRANS-DICHLORODIAMMINEPLATINUM(II). Roger James Adams (Iowa State Univ. of Science and Tech., Ames). Dissertation Abstr., 22: 3379(Apr. 1962).

The acid hydrolysis of trans-$[Pt(NH_3)_2Cl_2]$ was shown to occur to a measurable extent. For this reaction:

$$t\text{-}[Pt(NH_3)_2Cl_2] + H_2O \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} [Pt(NH_3)_2Cl(H_2O)]^+ + Cl^-,$$

the equilibrium quotient was measured at 15, 25, and 35°C. At 25°C the equilibrium quotient was 8.2×10^{-5} M at μ (ionic strength) = 0 and 32×10^{-5} M at $\mu = 0.318$. The indicated $\Delta H^{\ddagger}$ for the reaction was 5.5 kcal/mole. The rate constant, k_1, was found to be 9.8×10^{-5} sec^{-1} with an indicated $\Delta H^{\ddagger} = 19.6$ kcal/mole. This rate constant was nearly independent of ionic strength. Accordingly a mechanism for acid hydrolysis in which the rate determining step involves an intramolecular-rearrangement to yield a transition state of zero charge was proposed. The acid hydrolysis provided one pathway for the isotopic exchange between the chloride ligands and Cl^-. However, exchange experiments with Cl^{36} showed that in addition to the acid hydrolysis, a process, first-order in both trans-$[Pt(NH_3)_2Cl_2]$ and Cl^- with a rate constant of 7.8×10^{-4} sec^{-1} M^{-1}, contributed to the exchange. The $[Pt(NH_3)_3Cl]^+$ and the trans-$[Pt(NH_3)_2Cl_2]$ complexes are the only members of the entire series of chloroammineplatinum(II) compounds found to have a chloride dependent exchange. For this process $\Delta H^{\ddagger} = 19.6$ kcal/mole. The acid hydrolysis equilibrium for trans-$[Pt(NH_3)_2Cl(H_2O)]^+$ was too slight for detection by the methods available. However, it could be shown from the exchange experiments that the rate constant of any such reaction could not be substantially greater than k_1. The behavior of trans-$[Pt(NH_3)_2Cl_2]$ was contrasted to the behavior of the other chloroammine complexes of platinum(II).

23682 STUDIES ON THE REDUCED STATES OF THE GROUP IV TRANSITIONAL ELEMENTS. Tao-I Chiang (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 3381-2(Apr. 1962).

Earlier work on the x-ray powder patterns of the zirconium and hafnium trihalides contained some inconsistencies and was repeated and expanded. The powder patterns obtained from zirconium trichloride, tribromide, triiodide and hafnium triiodide were indexed on hexagonal axes with two molecules per unit cell. Their lattice parameters are: for $ZrCl_3$, a = 6.364 Å, c = 6.138 Å; for $ZrBr_3$, a = 6.752 Å, c = 6.315 Å; for ZrI_3, a = 7.249 Å, c = 6.641 Å; for HfI_3, a = 7.225 Å, c = 6.590 Å. The experimental densities for these compounds were: 2.95, 4.52, 5.13, and 6.17 g/cc; the densities calculated from the x-ray data are: 3.053, 4.415, 5.197, and 6.248 g/cc respectively. The x-ray data were interpreted in analogy with the work by Natta for the beta-form titanium trichloride. The space group $P6_3/mcm$ (D^3_{6h}) was assigned. The second part of this thesis was devoted to the study of the chemistry of titanium (III) chloride in nonaqueous solutions. The addition of solutions of titanium (III) chloride in acetonitrile or acetic acid to solutions of cesium chloride, rubidium chloride, trimethylphenylammonium chloride and tetraphenylarsonium chloride yielded precipitates of the following empirical formulas: $Cs_2TiCl_5 \cdot CH_3COOH$ (I), $9RbCl \cdot 4TiCl_3 \cdot CH_3COOH$ (II), $1.8C_6H_5N(CH_3)_3Cl \cdot TiCl_3$ (III), $[(C_6H_5)_4As]_2[Ti_4(CH_3COO)_8Cl_8] \cdot 3CH_3COOH$ (IV), and $(C_6H_5)_4AsTiCl_4 \cdot 1.5CH_3CN$ (V). The cesium compound was a yellow-green finely divided powder which did not melt below 300°. The infrared spectrum showed a carbonyl frequency shift which could be correlated to $Ti - O = C\begin{matrix}OH\\CH_3\end{matrix}$ bonding. It would appear here that the acetic acid molecule occupied the 6th coordinate position as an unidentate group. The x-ray data were indexed on the face-centered cubic lattice with a = 10.166 Å. There are four molecules per unit cell. The experimental density was 3.34 g/cc; the calculated density was 3.50 g/cc. The $\chi_M^{25°}$ was 564×10^{-6} c.g.s. The rubidium product was also a yellow-green finely divided powder which did not melt. The analytical data did not permit an assignment of an unambiguous formula. The infrared spectrum showed a wavelength shift for the carbonyl frequency comparable to that observed for the cesium compound. The product could be a mixture of $3Rb_2TiCl_5 \cdot CH_3COOH + Rb_2TiCl_5$ or $4Rb_2TiCl_5 \cdot CH_3COOH + RbCl$. The x-ray powder pattern was not completely indexed. The $\chi_M^{25°}$ was 485×10^{-6} c.g.s. The trimethylphenylammonium product was not homogeneous giving a green flaky material and a yellow crystalline product as well. The products decomposed without melting at 180°. The analytical data for both products were the same and conformed to the composition $1.8C_6H_5N(CH_3)_3Cl \cdot TiCl_3$ (III). X-ray powder patterns could not be indexed on the cubic or hexagonal lattice. The $\chi_M^{24°}$ was 824×10^{-6} c.g.s. The compound (IV) was isolated as yellow crystals which melted without decomposition at 118 to 19°. The compound (V) was isolated as orange crystals which melted without decomposition at 222 to 24°. In both cases, the infrared spectra indicated that bond formation occurred between the titanium atom and the solvent molecule in the crystal. X-ray single-crystal data for compound (V) indicated that it belonged to the triclinic system. The molecular volume of the unit cell is calculated to be 2,777 $Å^3$. The calculation is based on the experimental values of c = 20.96 Å, d_{100} = 12.78 Å, d_{010} = 8.83 Å and $Sin\gamma^* = 121° 36'$. The formula weight calculated by assuming four formula weights per unit cell was 640. The formula weight for the proposed formula is 634. The $\chi_M^{24°}$ were 406×10^{-6} c.g.s. for (IV) and 433×10^{-6} c.g.s. for (V). A crystalline compound with an empirical formula $Ti(C_5H_7O_2)_3Cl$ was prepared by following Pflugmacher's procedure. X-ray single crystal data indicated that this compound also belonged to the triclinic system. The molecular weight calculated assuming two molecules per unit cell was 543. This calculation was based on the measured unit cell dimensions: c = 7.54 Å, d_{100} = 20.40 Å, d_{010} = 8.07 Å and $Sin\gamma^* = 82°$. The molecular weight for the dimeric molecule is 562. The $\chi_M^{25°}$ was 621×10^{-6} c.g.s. The attempted preparation of zirconium (III) acetylacetone complex by reacting zirconium-tribromide with acetylacetone was unsuccessful. The compound monobromotriacetylacetono zirconium (IV), $Zr(C_5H_7O_2)_3Br$, was obtained. The magnetic susceptibility for each of the six compounds was measured with the Gouy method. Diamagnetic corrections were made. The calculated number of Bohr magnetons fell between 1.0 to 1.4. These values are comparable with the previously reported data of some known titanium (III) compounds.

23683 STUDIES OF RARE-EARTH HYDROGEN SYSTEMS. Kenneth Irvin Hardcastle (Univ. of Southern California, Los Angeles). Dissertation Abstr., 22: 3383(Apr. 1962).

A stainless-steel high-pressure line with a gage that permitted the measurement of pressures up to 65 atmospheres was built and the hydrides of lanthanum, cerium, and ytterbium investigated. The lanthanum- and cerium-hydrogen systems were studied and equilibrium dissociation pressure-temperature-composition data obtained. The results were compared with the low-pressure data of other authors and with the high-pressure results on the cerium–hydrogen system by Streck and Dialer. Lines of constant composition were drawn through plots of the log P versus reciprocal absolute temperature data. From the slopes of these lines values for the heats of dissociation were obtained for the following reaction $RH_{3-x} \rightarrow RH_{2-y} + \frac{1+y-x}{2} H_2$, where R represents the rare-earth metal and x and y depend essentially upon the temperature and pressure. Heats of dissociation of $LaH_{2.70}$

and $LaH_{2.88}$ are 6.6 and 6.8 kcal/mole H_2 respectively, while those for $CeH_{2.86}$ and $CeH_{2.90}$ are 6.5 and 6.8 kcal/mole H_2 respectively. The lattice constant for a specimen of $CeH_{2.97}$ was determined to be 5.539 ± 0.001 A. A higher hydride of ytterbium was prepared. Absorption of hydrogen at approximately 20 atmospheres and several hundred degrees by ytterbium samples resulted in the formation of hydrides having the compositions $YbH_{2.55}$, $YbH_{2.3}$, and $YbH_{2.58}$. X-ray diffraction photographs of these hydrides showed the presence of a new face-centered cubic phase. The value of the lattice constant of this phase was determined to be 5.1921 ± 0.0012 A. Thermally decomposed and quenched samples of $YbH_{2.55}$ having the compositions $YbH_{2.42}$ and $YbH_{2.04}$ were examined by x-ray diffraction techniques and found to contain an additional f.c.c. phase. The unit-cell constant of this phase was determined to be 5.2532 ± 0.0009 A. Annealing the sample of $YbH_{2.04}$ effected conversion of this metastable substance to orthorhombic ytterbium dihydride and to the f.c.c. (α = 5.192 A) higher ytterbium hydride. Measurements of the magnetic susceptibility of samples with 1.88 < H/Yb < 2.55 were carried out, using the Gouy method. The data could be interpreted in terms of mixtures of various amounts of virtually diamagnetic ytterbium dihydride, and a strongly paramagnetic higher hydride of ytterbium containing Yb^{3+} ions. Infrared absorption spectra for several ytterbium hydrides were obtained and compared with the spectrum for a sample of CaH_2. Isotherms of dissociation pressure versus composition for the region 1.9 < H/Yb < 2.6 consisted of two parts. Below approximately 13 atmospheres and 320°C plateaus were observed which indicated a two-solid-phase equilibrium, ytterbium dihydride, and the higher ytterbium hydride, while above these critical conditions only one solid phase existed. The investigations indicate that a solid with the composition $YbH_{\sim 2.5}$ is a stable phase in the YbH_2–YbH_3 system, and that the composition is dependent upon the pressure and temperature. From a van't Hoff plot of the plateau pressures versus reciprocal absolute temperature, the value for the heat of dissociation of $YbH_{\sim 2.5}$ was calculated to be 3.3 kcal/mole H_2. Attempts to prepare higher hydrides of europium and scandium by the reaction of the metals with hydrogen at several atmospheres and high temperatures were unsuccessful. Resistivity measurements on compressed, powder specimens of $LaH_{2.9}$, $CeH_{2.7}$, $PrH_{2.7}$, and $YbH_{1.9}$ showed respectively 10,000 ± 2,000, 27,000 ± 4,000, 20,000 ± 2,000, 30,000 ± 4,000 ohms/cm. The temperature coefficient of resistivity, α, was determined for $LaH_{2.88}$ to be $-0.006°C^{-1}$. Examination of a specimen of $LaH_{2.8}$ using nuclear magnetic resonance techniques showed that the proton resonance absorption line width was extremely narrow for solids, approximately 40 milligauss, which indicated rapid movement of the protons in the metal lattice. The line width increased as the sample was cooled, and at −190°C was broadened sufficiently so as to be unobservable. This is interpreted as being due to the immobility or "freezing out" of the protons at these temperatures. X-ray powder diffraction photographs of $LuH_{2.9}$ were interpreted on the basis of a hexagonal closest-packed lattice of lutetium atoms with unit-cell constants of a = 3.57$_3$ A and c = 6.43$_4$ A.

23684 STABILITY CONSTANTS OF SOME RARE-EARTH-METAL CHELATES. Robert Harreld Karraker (Iowa State Univ. of Science and Tech., Ames). Dissertation Abstr., 22: 3385(Apr. 1962).

The first three successive formation or stability constants of the rare-earth complexes with glycolic and lactic acids were measured at an ionic strength of 0.1 and at 20 ± 0.02°C. The method used involved a potentiometric measurement of pH with a glass electrode. With both ligands, the first stability constants increased in value with increasing atomic number of the central ion across the series from lanthanum to europium, and again from gadolinium to lutetium. There was, however, a decrease between europium and gadolinium which caused an overlap between the two halves of the series. This overlap was more pronounced with glycolate than with lactate. The lactate stability constants were stronger than the corresponding glycolate constants, and both were much stronger than the rare-earth acetate constants. The glycolate constants were found to be over twice as strong as had been previously reported at 2.0 ionic strength. It was postulated that the complexing agents were bidentate ligands with the hydroxyl group participating in the chelate formation. The stability constants of the rare-earth chelates with 1,2-diaminocyclohexane-N,N,N',N'-tetraacetic acid were determined by polarographic comparison with cadmium, zinc, and europium complexes at 0.1 ionic strength and 20 ± 0.02°C. These constants were found to increase linearly with atomic number across the complete series with the exception of gadolinium and possibly lanthanum. Both the gadolinium and lanthanum constants were low, but the margin of error in the lanthanum constant determination was relatively large.

23685 KINETICS OF LIGAND AND DEUTERIUM EXCHANGE REACTIONS OF SOME CARBONATO-AMINE COBALT(III) COMPLEX IONS. (PARTS I AND II). Gabriel Lapidus (Univ. of Buffalo). Dissertation Abstr., 22: 3385 (Apr. 1962).

The kinetics of exchange between carbonato-bis-(di, propylenediamine)Co(III) ion, $((pn)_2)$, and C-14 labeled carbonate was studied over the pH range 7.8 to 10.39 in borate buffer, and the results compared with those for the pentammine $((N)_5)$, tetrammine $((N)_4)$ bis-ethylenediamine $((en)_2)$, and bis-trimethylenediamine $((tn)_2)$ analogs already studied. Additional work was also done on the last named analog. The considerably extended acidity profile, coupled with the study of the variation of the rate of exchange with total free carbonate concentration at widely different pH's, showed that the mechanisms previously assigned to the analogs, were not entirely general. The previous rate expressions were: $R = k' a\, b\left(\frac{K_4(H^+)}{K_4(H^+)+1}\right) + k'' a(H^+)$ (for $(N)_5$, $(N)_4$, and $(en)_2$), and $R = k' a\, b\left(\frac{K_5(H^+)}{K_4(H^+)+1}\right) + k'' a$ (for $(tn)_2$). The new rate expression, and one which is entirely general for all the analogs over a pH range 7.8 to 9.9 (above which, incipient decomposition sets in) is:

$$R = k' a\left(\frac{K_5(H^+)}{K_5(H^+)+1}\right) b\left(\frac{K_4(H^+)}{K_4(H^+)+1}\right) + k'' a\left(\frac{K_5(H^+)}{K_5(H^+)+1}\right)(H_2O)$$

a, b, are the total complex ion and free carbonate concentrations respectively, k' and k'' the specific rate constants, K_4 the second formation constant for carbonic acid, and K_5 the experimentally observed formation constant for the bicarbonato form of the complex ion. A precise determination of K_5 for $(pn)_2$ and $(tn)_2$ were made, and, calculated for the other analogs from their existing data. The magnitude of K_5 for $(N)_4$, $(en)_2$, $(pn)_2$, and $(tn)_2$ is of the same order of magnitude as K_4 for the free CO_3^{2-} ion, namely 10^{10}; the magnitude of K_5 for $(N)_5$ is 10^8, in contrast to Lamb's value of 10^7. Hydrogen-deuterium exchange studies were carried out on $Co(N)_4CO_3^+$, $Co(en)_2CO_3^+$, $Co(en)_2C_2O_4^+$, $Co(tn)_2CO_3^+$, $Co(en)_3^{+3}$, and $Co(tn)_3^{+3}$ under identical conditions. This was done with the aim of correlating the relative rates of H-D

exchange with the corresponding rates of ligand exchange (the oxalato was done to see the effect of added "chelate ability" of the oxalate ligand compared to the carbonate ligand). The apparent parallel between the H-D and ligand exchange rates for the carbonato analogs suggest a mechanistic connection between the two exchange processes, namely, that the increasingly more difficult ligand exchange is a function of increasingly stronger O-H-N intramolecular hydrogen bonding.

23686 THE PHOTOCHEMISTRY OF COMPLEX IONS. Steven Tremble Spees, Jr. (Univ. of Southern California, Los Angeles). Dissertation Abstr., 22: 3387-8(Apr. 1962).

Although the general light sensitivity of Werner-type complexes has been known for some time, quantitative studies have been made just recently. The effect of light on aquation, substitution, and oxidation-reduction reactions has been studied, but there has been no report of the effect on racemization reactions. This work reports the photoracemization of complex $K_3[Cr(C_2O_4)_3]$—the first photoracemization reaction reported. Also, evidence for photoracemization in Co (III) complexes was found. The quantum yield for the photoracemization of $K_3[Cr(C_2O_4)_3]$ is independent of the concentration of complex, light intensity, and wavelength of irradiating light. There is a small temperature effect which gives an activation energy of 2.1 kcal/mole. The form of the rate equation is $\ln\phi = 1.30 - 1053/T$, which gives a quantum yield of 0.11 at 25°C. Organic solvents decrease the rate of thermal racemization of $K_3[Cr(C_2O_4)_3]$, e.g., in a 30 mole per cent aqueous ethanol solution the half life for thermal racemization is 10 times larger than in water. There seems to be some correlation between the water activity and the rate constant for thermal racemization; i.e., at a given water activity the half life is the same in different solvent systems. This is also true of the quantum yield in mixed aqueous organic solvents. The quantum yield in the particular solvent system mentioned is about 0.6 times that found in water—an effect which is approximately the same as the decrease in water activity. A similar but opposite effect is observed for acid solutions where the rate of thermal racemization is greatly increased at low pH values. However, the quantum yield is only slightly decreased in an acid solution where the thermal rate constant is 6 times larger than in a neutral solution. The rate of O^{18} exchange with solvent water in $K_3[Cr(C_2O_4)_3]$ is 2.5 times smaller than the rate of thermal racemization. The quantum yield for exchange is also 2.5 times smaller than the quantum yield for photoracemization. A similar effect is observed in D_2O. The ratio for the race of racemization in H_2O compared with D_2O is 1.25; this is the same ratio as found for the quantum yields in these two solvents. This investigation seems to indicate that the mechanism for racemization is the same in the light as in the dark. The first step is considered to be the loosening of one end of an oxalate ligand, the energy being supplied either thermally or photochemically. Both the racemization and O^{18} exchange take place from this monodentate oxalate activated complex. The actual racemization mechanism might involve an internal oxalate displacement which would lead to racemization if the end of the displaced oxalate ligand reattached itself at the place where the original Cr–O bond breaking occurred. The oxalate exchange and acid-catalyzed aquation of $K_3[Cr(C_2O_4)_3]$ can also take place from the monodentate oxalate activated state. The studies with Co(III) complexes show that photoracemization is also possible with compounds of a different transition metal. Good evidence was found for the photoracemization of $K_3[Co(C_2O_4)_3]$, although the primary reaction is photodecomposition. The ratio of the quantum yield from decomposition measurements to the quantum yield for loss of optical activity measurements is 2.15 ± 0.10 for the two visible bonds in $K_3[Co(C_2O_4)_3]$. The light-induced decomposition of this complex is independent of concentration and of temperature at shorter wavelengths. When the visible peak at 605 mμ is irradiated, an activation energy for photodecomposition of about 6 kcal/mole is found. Preliminary studies show that $K_3[Rh(C_2O_4)_3]$ and K[Co(edta)] undergo some photoracemization. The optically active complexes $[Co(en)_3]Cl_3$, $[Co(en)_2(C_2O_4)]Cl$, and $[Co(en)_2(NO_2)_2]Cl$ are not affected by light. Evidence for a stereospecific aquation reaction was found when optically active $[Co(en)_2Cl_2]Cl$ is irradiated with visible light. Also photoisomerization was observed with $[Co(en)_2(H_2O)Cl]Cl_2$, the change from the cis to the trans form being accelerated by light.

23687 SOLID SOLUTIONS OF SODIUM NIOBATE AND SELECTED NON PEROVSKITE NIOBATES. Raymond George Capek (Univ. of Illinois, Urbana). Dissertation Abstr., 22: 3562(Apr. 1962).

The solid solutions of sodium niobate, $NaNbO_3$, and strontium metaniobate, $SrNb_2O_6$, and sodium niobate and lithium niobate, $LiNbO_3$, were investigated as to their compositional limits and their electrical characteristics. The solid solution formation was determined by x-ray diffraction patterns, and the electrical characteristics were studied by means of dielectric constant and dissipation factor versus temperature measurements and hysteresis loop measurements. The sodium-strontium niobate series of compositions, $Na_{1-x}(Sr_{0.5})_xNbO_3$, formed solid solutions from $x = 0$ to $x = 0.45$. For this solid solution, one strontium ion plus one vacancy replaced two sodium ions; thus it was a defect solid solution. The solid solutions were formed much more readily from the raw materials, Na_2CO_3, $SrCO_3$, and Nb_2O_5 than from the niobate compounds, $NaNbO_3$ and $SrNb_2O_6$. The sodium-lithium niobate series of compositions, $Na_{1-x}Li_xNbO_3$, formed solid solutions from $x = 0$ to $x = 0.05$. This solid solution was formed by a direct replacement of one lithium ion for one sodium ion. The solid solution formation from the raw materials, Na_2CO_3, Li_2CO_3, and Nb_2O_5 or the niobate compounds, $NaNbO_3$ and $LiNbO_3$ required the same heat treatment. The dielectric constant and dissipation factor versus temperature measurements were made in the temperature range of −150 to 500°C. The measurements were made at a frequency of 50 kc as this was the lowest frequency which kept the electrical losses low enough so that they didn't interfere with the dielectric constant peaks. The frequency greatly influenced the dissipation factor measurements but only slightly affected the dielectric constant values. The additions of $Sr_{0.5}NbO_3$ to $NaNbO_3$ increased the peak dielectric constant value from 1120 for $NaNbO_3$ to 2840 for $Na_{0.7}(Sr_{0.5})_{0.3}NbO_3$. Increasing the $Sr_{0.5}NbO_3$ content beyond $Na_{0.7}(Sr_{0.5})_{0.3}NbO_3$ decreased the peak dielectric constant values. The transition temperature of the $Na_{1-x}(Sr_{0.5})_xNbO_3$ series decreased linearly with $Sr_{0.5}NbO_3$ additions to composition $Na_{0.8}(Sr_{0.5})_{0.2}NbO_3$ at which point another transition thus a second phase, Phase II, appeared. The transition temperature between Phase I and Phase II decreased linearly with $Sr_{0.5}NbO_3$ additions to the limit of the solid solution region, composition $Na_{0.55}(Sr_{0.5})_{0.45}NbO_3$. The transition temperature between Phase II and Phase III decreased linearly with $Sr_{0.5}NbO_3$ additions to composition $Na_{0.6}(Sr_{0.5})_{0.4}NbO_3$. Hysteresis loop measurements with applied fields of 30 kv/cm showed Phase I and II to be ferroelectric and Phase III to be non-polar. Phase III was

paraelectric as it obeyed the Curie Weiss Law. Raising the temperature or increasing the $Sr_{0.5}NbO_3$ content of the compositions in Phase I decreased their coercive force and increased their polarization while for compositions in Phase II these changes lead the opposite effect. The additions of $LiNbO_3$ to $NaNbO_3$ increased the peak dielectric constant value from 1120 for $NaNbO_3$ to 2100 for $Na_{0.95}Li_{0.05}NbO_3$, the limit of the solid solution region. The transition temperature of the $Na_{1-x}Li_xNbO_3$ series decreased linearly with $LiNbO_3$ additions to the limit of the solid solution region. The region above the transition temperature was the paraelectric region, but the electrical nature of the region below the transition temperature could not be determined as the electrical losses of the samples made the hysteresis loop measurements inconclusive.

23688 DIELECTRIC BEHAVIOR IN THE SYSTEMS $PbHfO_3-BaHfO_3$ AND $PbHfO_3-SrHfO_3$. David Lavern Wilcox (Univ. of Illinois, Urbana). Dissertation Abstr., 22: 3569-70(Apr. 1962).

Phase transitions in the systems $(Pb_xBa_{1-x})HfO_3$, where x varies from 1.00 to 0.60, and $(Pb_ySr_{1-y})HfO_3$, where y varies from 1.00 to 0.80, were investigated by dielectric and structural measurements. The ceramic samples were prepared by conventional ceramic fabrication techniques from analytical grade raw materials. Alkaline earth carbonates and basic lead carbonate supplied the +2 valence metal ions and a high purity hafnium oxide (99.95% HfO_2) was the source of Hf^{4+}. The sample densifying, firing operation was accomplished in a lead oxide atmosphere to reduce volatilization. The dielectric behavior of the phases present in the two systems was studied by employing measurements of dielectric constant as a function of temperature, electric polarizability versus applied field, and x-ray techniques. Lead hafnate has two anomalies in the dielectric constant versus temperature curve which appear at 160°C and 208°C. The first anomaly represents a phase transition from the lower temperature, antiferroelectric, pseudotetragonal phase to the upper temperature, antiferroelectric, pseudotetragonal phase of another type. The second anomaly at 208°C is the temperature at which the upper antiferroelectric phase transforms to a cubic, paraelectric phase. The dielectric constant of ceramic $PbHfO_3$ is 120 at room temperature and about 2000 at 208°C. Increasing barium additions in $(Pb_xBa_{1-x})HfO_3$ decrease both transition temperatures which occur in $PbHfO_3$. A ferroelectric region was found in the $(Pb_xBa_{1-x})HfO_3$ system at room temperature with $x > 0.60$ but < 0.80. The $Pb_{0.70}Ba_{0.30}HfO_3$ which was in the ferroelectric region at room temperature was determined to have a rhombohedral pseudo-cubic structure with $\alpha = 89° 54'$. The morphotropic phase boundary between the upper temperature antiferroelectric phase and the ferroelectric phase in $(Pb_xBa_{1-x})HfO_3$ was determined to lie between the compositional limits where $x < 0.90$ but > 0.85, depending on the temperature. In the system $(Pb_ySr_{1-y})HfO_3$, strontium additions reduced the lower phase transition temperature. Small additions (~5%) of strontium caused a slight increase in the upper phase transition temperature of lead hafnate but further additions reduced the transition temperature. An additional phase transition was observed at a temperature which was above the upper antiferroelectric transition temperature of $PbHfO_3$. The temperature of the new phase transition increased as the amount of strontium in $(Pb_ySr_{1-y})HfO_3$ increased. The two non-polar phases in the $(Pb,Sr)HfO_3$ system which corresponded to those which occur in $PbHfO_3$ were probably antiferroelectric whereas the new phase which was observed could be explained as either a paraelectric or an antiferroelectric phase. A determination of the room temperature c/a axis ratio of $PbHfO_3$ and its pseudotetragonal solid solutions with $BaHfO_3$ and $SrHfO_3$ indicated that the magnitude of the ratio was related to the upper phase transition temperature. In the $(Pb,Ba)HfO_3$ system, the c/a ratio increased from 0.989 for $PbHfO_3$ to 0.994 for $Pb_{0.80}Ba_{0.20}HfO_3$ as the ratio increased the upper phase transition temperature decreased. In the $(Pb,Sr)HfO_3$, the c/a ratio remained nearly constant for small strontium additions and then increased toward unity. The delay in the change of the ratio corresponded with the slight increase in the upper phase transition temperature. It was believed that as the c/a axis ratio of the room temperature pseudotetragonal phase approached unity, less thermal energy was required to cause a transformation to the higher symmetry phase which resulted in the observed decrease in the upper transition temperature.

23689 THE HEAT CAPACITY OF SOLID He^3 UNDER PRESSURE. Eugene Casmir Heltemes (Iowa State Univ. of Science and Tech., Ames). Dissertation Abstr., 22: 3711 (Apr. 1962).

The heat capacity of solid He^3 was measured from 0.3 to 2°K at 17 molar volumes from 12.0 to 24.4 cm^3, using a magnetic refrigerator to cool the samples. The molar volumes were determined indirectly from the changes in the cooling rate of the calorimeter as it cooled through the melting transition at constant volume. Values are given for the Debye θ and Gruneisen constant γ for both phases of solid He^3, and for solid He^4. An anomalous contribution to the specific heat was found in the α phase, which can be expressed in terms of a characteristic temperature ϕ, and obeys an Einstein specific heat relationship for a system with two degrees of freedom. The temperature ϕ appears to be a linear function of volume. The low temperature data indicate a finite extrapolated value of C/T at $T = 0$ which appears at all molar volumes except possibly the larger ones. This effect was not observed in measurements on the empty calorimeter. Limits are placed on the molar volume at which the $\alpha-\beta$ transition occurs down to 0.3°K.

23690 EFFECT OF ISOTOPIC COMPOSITION ON INFRARED ABSORPTION OF THIN FILMS OF LITHIUM FLUORIDE AND LITHIUM HYDRIDE. Ramzi Hanna Misho (Michigan State Univ., East Lansing). Dissertation Abstr., 22: 4386(June 1962).

The interaction of electromagnetic radiation with crystalline lattices is studied by observing the absorption of far-infrared radiation in thin films of certain simple substances evaporated on various substrates. To elucidate the nature of lattice vibrations, the isotopic composition of the absorbing substance is varied. The substances studied are lithium fluoride made from varying proportions of Li^6 and Li^7 in combination with F^{19}, and lithium hydride made from varying proportions of Li^6 and Li^7 in combination with H^1 and H^2. The substrates are polyethylene, potassium bromide, and cesium bromide. Observations are made in the wavelength region 10 to 40 microns, and at film temperatures of 300, 200, and 120°K. Each resulting spectrum is inspected for a principal absorption line and for subsidiary lines. The shape of the principal line is examined, and the variation of the parameters characterizing it, are studied with respect to isotopic composition, temperature, and nature of the substrate. So far as dependence on isotopic mass is concerned, the position of maximum absorption for isotopically pure LiF and LiH follows quantitatively the predictions of the elementary portion of the Born theory, namely, that the dispersion wavelength is proportional to the square root of the reduced mass. The positions of the

absorption maxima for isotopically impure LiF^{19} are intermediate between those for pure Li^6F^{19} and Li^7F^{19}, and are in agreement with the elementary Born theory if the average isotopic masses are used. The positions of the absorption maxima for isotopically impure LiH do not follow any simple law. So far as dependence on temperature is concerned, the dispersion wavelengths for pure and impure LiF and LiH (with the exception of Li^6H^1 and Li^7H^1) decrease slightly with decreasing temperature, as would be expected theoretically. The absorption bands of all the pure and impure LiF and LiH become deeper and narrower with decreasing temperature, in qualitative agreement with theory. The effect of substrate, though not pronounced, is complicated and difficult to understand. It may be concluded generally that although the main features of the interaction of electromagnetic radiation with crystalline lattices are understood, most of the details cannot be predicted quantitatively, and great improvement in the theory is needed.

23691 INFRARED ABSORPTION SPECTRA OF ISOTOPICALLY-ENRICHED LITHIUM HYDRIDE. Walter Bruce Zimmerman (Michigan State Univ., East Lansing). Dissertation Abstr., 22: 4389(June 1962).

This work is an extension of a program exploiting isotopic mass and isotopic composition as probes for liquid-state and solid-state investigations to the study of the interaction of electromagnetic radiation with crystal lattices. The infrared absorption spectrum of thin films (less than 0.1μ) of solid lithium hydride made of varying proportions of its separated isotopes (Li^6, Li^7, H^1, H^2) was obtained at room temperature in the wavelength region of 12.5 to 25μ. The primary feature of the spectrum of the relatively pure materials Li^6H^1, Li^6H^2, Li^7H^1, Li^7H^2 is a broad but definite absorption peak at the dispersion wavelengths 16.9, 22.2, 17.6, 22.4 ± 0.02μ, respectively. The ratios of the dispersion wavelengths of Li^6H^2 and Li^6H^1, Li^7H^2 and Li^7H^1, Li^7H^1 and Li^6H^1, Li^7H^2 and Li^6H^2 are: 1.31, 1.32, 1.01, 1.01 ± 0.02, respectively, which are in excellent accord with the respective ratios of the square root of the reduced masses: 1.32, 1.33, 1.01, 1.01. This agreement for the effect of isotopic mass on the dispersion wavelength of an ionic crystal is in accord with a prediction of the elementary Born theory of lattice vibrations. The effect of isotopic composition on the infrared spectrum of mixtures of Li^6H^1 and Li^6H^2 appears to be complex. The dispersion wavelengths for the compositions Li^6[72.1% H^1, 27.9% H^2], Li^6[57.0% H^1, 43.0% H^2], Li^6[19.9% H^1, 80.1% H^2] are: 21.2, 21.4, 21.8 ± 0.02μ, respectively. The ratios of the dispersion wavelengths of Li^6[72.1% H^1, 27.9% H^2] and Li^6H^1, Li^6[57.0% H^1, 43.0% H^2] and Li^6[72.1% H^1, 27.9% H^2], Li^6[19.9% H^1, 80.1% H^2] and Li^6[57.0% H^1, 43.0% H^2], Li^6H^2 and Li^6[19.9% H^1, 80.1% H^2] are: 1.25, 1.01, 1.02, 1.02 ± 0.02, respectively, which are in disagreement with the respective ratios of the square roots of the average reduced masses: 1.09, 1.05, 1.10, 1.04. Therefore, the effect of isotopic composition on the dispersion wavelength of an ionic crystal cannot be explained simply by considering the composite film as being equivalent to one made up of isotopes with the average reduced mass.

23692 THE DENSITIES OF KCl–RbCl CRYSTALS AND THE DIFFUSION OF RUBIDIUM IONS IN THESE CRYSTALS. L. L. Makarov, B. G. Lur'e, and V. N. Malyshev. Fiz. Tverdogo Tela, 2: 88-92(1960).

The diffusion of Rb^+ ions was investigated with the help of the radioisotope, Rb^{86}. The diffusion coefficient, D, of Rb^+ ions was measured in polycrystalline solid-solution specimens in the form of 10 mm tablets of 2 mm thickness. Rb^{86} was evaporated on the surface in vacuo up to an activity of 20,000 pulse/min. The activated tablet was placed with a second tablet into a quartz ampoule and annealed in close contact with it from 570 to 760°C. The distribution of the diffused ions was measured by sectioning, and an activity analysis of the sections was made with an end-window counter. The results showed a similarity between melting, liquefaction, diffusion coefficient, and defect concentration curves in solid solutions. The diffusion coefficient, $D \times 10^9$ cm^2/sec, for temperatures from 640 to 710° for K(Rb)Cl equimolecular solid solutions varied from 0.52 to 2.00. The activation energy for the diffusion of Rb^+ ions was calculated from experimental data at 35,000 ± 3000 cal. (OID)

23693 RESULTS OF LOW TEMPERATURE RESEARCH. XXXVII. THE VAPOR PRESSURE DIFFERENCE OF SO_2 AND SO_2^{18} BETWEEN THE MELTING AND BOILING POINTS. K. Clusius, K. Schleich, and R. B. Bernstein (Universität Zürich). Helv. Chim. Acta, 45: 252-60(1962). (In Swedish)

Sulfur dioxide belongs to the substances which noticeably associate in the liquid and in the gaseous phases. A study was made to determine whether large vapor pressure differences occur between ordinary SO_2 and SO_2^{18}. The preparation and purification of the labeled SO_2, whose oxygen is 97.1 at. % O^{18}, are described in detail. The vapor pressure comparison shows only a very small isotope effect. The boiling point of the heavy molecule is 0.02_1 and the melting point 0.02_7° higher. Its heat of evaporation is approximately 2.6 ± 0.3 cal/mole higher. (tr-auth)

23694 THERMODYNAMICS OF NUCLEAR MATERIALS. Intern. At. Energy Agency Bull., 4: No. 3, 23-4(July 1962).

A brief description is given of the Symposium on the Thermodynamics of Nuclear Materials held in Vienna on May 21 to 25, 1962. The current status of thermodynamics of nuclear materials and their determination is discussed. (D.L.C.)

23695 POLAROGRAPHIC STUDIES OF ELECTRODE REACTIONS OF Ti(IV) – Ti(III) COMPLEXES IN HYDROCHLORIC SOLUTIONS. A. G. Stromberg and A. I. Kartushinskaya (Tomsk Polytechnic Inst., USSR). Izvest. Sibir. Otdel. Akad. Nauk S.S.S.R., No. 11, 88-97(1961). (In Russian)

A series of experiments with Ti(IV) – Ti(III) in hydrochloric acid was carried out at various hydrogen and chloride ion concentrations. Calculations of equilibria and participating Ti(IV) and Ti(III) complexes indicate prevailing complexes of $Ti(OH)_2Cl_2$ or $TiOHCl^{2+}$ and Ti^{3+} and participating complexes of $TiOHCl^{2+}$ and $TiOHCl^+$. The standard electrode potential and current density for Ti(IV) and Ti(III) recharge in hydrochloric reactions were calculated. (R.V.J.)

23696 RAPID AND EFFICIENT PURIFICATION OF AMERICIUM. Thomas K. Keenan (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem., 20: 185-8 (Dec. 1961).

About 200 mg of Am^{241} was brought to >99.8% chemical purity by simple ion-exchange and precipitation operations. Both dilute and concentrated ammonium thiocyanate solutions were used as eluting agents in conjunction with cation and anion exchangers to achieve this purity. The thiocyanate-resin system was not effective in purifying Cm^{244}. Even at comparable levels of total alpha activity, much more thiocyanate decomposition was observed with curium than with americium. The specific activity or density of alpha radiation is postulated as the controlling factor. (auth)

23697 PREPARATION OF ANHYDROUS LANTHANON ACETATES BY DESOLVATION. J. R. Witt and E. I. On-

stott (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem., [23]: (July or Aug. 1961).

Anhydrous acetates of Y, La, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu were prepared by desolvation of the acetates in vacuum at 150°C after dissolution of the oxides in 50% acetic acid and evaporation to dryness. Acetates of Pr and Nd did not reach constant composition before decomposition occurred. A hemihydrate of Sm acetate was formed which decomposed at temperatures above 150°C without converting to the anhydrous acetate. Hemihydrates of Tb and Ho were formed at about 75°C. (auth)

23698 PURE ROTATIONAL SPECTRUM OF NT_3. Robin S. McDowell and Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Mol. Spectroscopy, 9: 79-80 (July 1962).

Absorption lines of NT_3 were recorded with a single-pass grating spectrometer constructed around a monochromator. A high-pressure mercury arc was used as a source. The cell was equipped with two traps, one containing activated charcoal, to provide for pressure control and for removal of the decomposition products N_2 and T_2. Calculations gave $B = 3.521 \pm 0.003\ cm^{-1}$ and $D_J = (5.8 \pm 0.5) \times 10^{-3}\ cm^{-1}$. Data are tabulated, and frequencies are believed to be accurate to $\pm 0.10\ cm^{-1}$. (P.C.H.)

23699 THE INFLUENCE OF ZETA ELECTROKINETIC POTENTIAL ON THE RATE OF SEDIMENTATION OF U_3O_8-SUSPENSION. Pavel Imriš. Jaderná energie, 8: 125-6(1962). (In Czech)

An electrophoretic measurement of relative value changes of electrokinetic potential of a suspension of U_3O_8 in the dependence on stabilizing electrolyte (sodium pyrophosphate, NaOH, KOH, HCl, HNO_3) concentration and kind is described. A method of sedimentation rate measurement of a suspension of U_3O_8 for small and great concentrations (up to 10 g U_3O_8/l and up to 140 g U_3O_8/l) on the principle of natural radioactivity measurement of uranium and on the principle of gamma radiation absorption in mass is reported. The results of electrokinetic potential change measurement are compared with sedimentation rate measurement of the suspension of U_3O_8. (auth)

23700 ABSORPTION AND DIFFUSION OF XENON IN HIGH DENSITY GRAPHITE AT HIGH TEMPERATURES. Frank J. Salzano and Allen M. Eshaya (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. Eng., 12: 1-3(Jan. 1962).

Absorption isotherms of xenon on type R-4 high density graphite were measured at 750 and 1000°C using radioactive tracer xenon. The measured magnitudes of the absorption and the shape of the isotherms indicate that the greatest fraction of the sorbed gas is contained within the pores of the graphite. A comparison of the measured and theoretical density of graphite with the measured absorptions indicated that xenon completely filled the pores of the graphite. Measurements of the rate of diffusion of xenon into evacuated graphite at 750 and 1000°C were made by equilibrating for times shorter than required to achieve equilibrium. Considerable variations in rates of absorption were found for the same type of graphite fabricated as round stock and flat stock. The experimental data are discussed in light of the postulated transport mechanism. (auth)

23701 ENTHALPY—ENTROPY DIAGRAM OF XENON. Frank Maslan (Brookhaven National Lab., Upton, N. Y.). Nucleonics, 21: No. 3, 53(Mar. 1962). (BNL-4811)

The properties of xenon were investigated and an enthalpy-entropy diagram, which covers the range of 0 to 150°C and 0 to 2800 atm, was plotted. These coordinates were chosen as a convenient way of presenting the data since it is all in the superheated region. (P.C.H.)

23702 ELECTRON SPIN RESONANCE OF ALKALI ATOMS IN INERT-GAS MATRICES. C. K. Jen, V. A. Bowers, E. L. Cochran, and S. N. Foner (Johns Hopkins Univ., Silver Spring, Md.). Phys. Rev., 126: 1749-57 (June 1, 1962).

The electron spin resonance spectra of alkali atoms (Li, Na, K, Rb, Cs) trapped in inert-gas matrices (Ar, Kr, Xe) at liquid-helium temperature were observed. The principal hyperfine structure for each alkali atom follows very closely the pattern prescribed by the known hyperfine constants. Around the position of each hyperfine component, there is, in most cases, a multiple line structure associated with multiple trapping sites in the particular matrix. Values of $\Delta A/A_0$ and Δg_j, tabulated in all cases to describe the matrix effects on the spin resonance, depend upon the nature of the trapping site as well as the character of the matrix. Matrix effects on the electron spin resonance spectra of trapped alkali atoms are treated theoretically by an approach similar to that used in a study of trapped hydrogen atoms. The effect of the repulsive interactions (Coulomb and exchange) is found to be very prominent for alkali atoms in inert-gas matrices. The repulsive energy is approximated by the corresponding part of the Lennard-Jones potential. A calculation of the quantities $\Delta A/A_0$ and Δg_j was carried out for the case of Li in Ar. Theoretical and experimental results agree, assuming that the Li atoms are trapped in substitutional sites. No satisfactory explanation for the phenomenon of multiple trapping sites for the alkali atoms was found. (auth)

23703 MEASUREMENT OF SPIN-LATTICE RELAXATION TIME IN SUPERCOOLED SOLUTIONS OF Ti^{3+} BY THE CONTINUOUS SATURATION METHOD. N. S. Garif'yanov, V. N. Fedotov, and R. Kh. Timerov (Academy of Sciences, Kazan Branch, USSR). Soviet Phys.-Solid State, 4: 67-8(July 1962).

Spin-lattice relaxation times T_1 in supercooled glycerine solutions of $TiCl_3 \cdot 6H_2O$ at 77°K were measured by the continuous saturation method using a frequency of 270 Mc. T_1 was found to be dependent not only on the Ti^{3+} concentration, but also on the Co^{2+} content of the solution under test. (auth)

23704 THE MEASUREMENT OF DIFFUSION COEFFICIENTS IN SOLIDS AT VARIOUS TEMPERATURES WITH A CONTINUOUS PROCESS ACCORDING TO THE METHOD OF RADIOACTIVE SURFACES. J. Noelting (Universität Göttingen, Ger.). Z. physik. Chem. (Frankfurt), 32: 154-67 (May 1962). (In German)

A process for measurement of diffusion coefficients in solids is described, with which, through strongly defined heating of a diffusion probe, the diffusion coefficients appearing while passing through various temperature regions can be determined in a single measurement process. A comparison with previously performed measurements of iodine diffusion in α-AgI showed that the measurement accuracy is in no way inferior to the discontinuous surface method. The very slow and uniform heating of the experimental probe allows the use of this method to appear especially favorable for the investigation of diffusion in single crystals and ionic crystals with slower standardization of the defect arrangement equilibrium. (tr-auth)

23705 VIBRATIONAL SPECTRA OF PARTIALLY DEUTERATED AND TRITIATED STIBINES. P. N. Daykin and S. Sundaram (British Columbia Research Council, Vancouver, Canada). Z. physik. Chem. (Frankfurt), 32: 222-8 (May 1962). (In English)

Using the quadratic potential energy constants for stibine and stibine-d_3 obtained earlier, the harmonic vibrational

wave numbers of all the partially deuterated and tritiated stibines were determined. Based on a first-order perturbation theory, the rotational distortion constants were obtained for these molecules. The molar thermodynamic properties of heat capacity, heat content, free energy, and entropy were calculated for 1 atm pressure for a rigid-rotor harmonic-oscillator approximation. The mean square amplitudes of vibrations were also computed from the vibrational frequencies and the force fields for 25°C. (auth)

23706 THE RADIOCHEMICAL DETERMINATION OF SMALL SOLUBILITIES. K. H. Lieser. p.115-18 of "Analytische Chemie. Mitteilungsblatt der Chemische Gesellschaft in der Deutschen Demokratischen Republik, Berlin, 1960."

The description of solution processes by indicating only the dissolved ions and disregarding the undissociated molecules is incomplete and any determination of solubilities based on this concept is incorrect. This shortcoming does not apply to radiochemical operations which comprise both the dissociated and undissociated molecules and, therefore, must be given preference over other methods, especially when the number of molecules that go into solution is relatively large. This difference is illustrated by measuring the total solubility (a) of silver-halogen compounds in water and sodium-halogen solutions using Ag^{110} and Ag^{111}, and (b) of silver-halogen compounds in water and silver nitrate solutions by labeling them with Cl^{38}, Br^{82}, or I^{131}. In all cases, the solubility of undissociated molecules becomes apparent. A further application is the determination of the solubility of strontium thiocyanates which play an important role in analytical chemistry as a means of separating Sr from Ca. The solubility was found to be 5.6×10^{-6} m/l at 20°C. (OID)

Radiation Chemistry and Radiochemistry

Refer also to abstracts 24041, 24044, 24265, 24339, 24340, 24342, 24587, 24588, and 24589.

23707 (ARL-62-350) GAMMA IRRADIATION OF FLUOROCARBON POLYMERS AND SMALL MOLECULES. L. A. Wall and R. E. Florin (National Bureau of Standards, Washington, D. C.). May 1962. Contract AF33(616)-60-4. 8p.

Work upon the effects of gamma irradiation of fluorocarbon polymers and small molecules is summarized, including a list of publications. The subject matter includes physical properties (principally zero-strength-times and tensile strengths); volatile products; effects of oxygen and chlorine atmospheres; radiation chemistry of perfluoroheptane, hexafluorobenzene, and mixtures; sensitizing of radiation— induced polymerization; and yields of radicals by electron spin resonance. (auth)

23708 (CEA-1991) ÉTUDE DE QUELQUES SYNTHÈSE DE COLORANTS THIAZINIQUES ET INDAMINIQUES AMORCÉES PAR LES RAYONNEMENTS IONISANTS (THÈSES). (The Study of Some Thiazinic and Indaminic Dye Syntheses Induced by Ionising Radiation (thesis)). Serge Balestic (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1962. 86p. Submitted to Université, Paris.

With a view to finding some radiochemical reactions applicable on an industrial scale for evaluating the radioactive waste from reactors, a systematic study was made of the radiochemical synthesis of thiazinic dyes such as methylene blue and Lauths' violet. The study concerned the identification and the dosage, during radiolysis, of dyes by means of their absorption spectra after separation from the reaction medium by adsorption chromatography or ion-exchange; other radiolysis products such as ammonium chloride and hydrogen peroxide were also identified. By systematically varying the physico-chemical parameters it was possible to determine the most favorable conditions for radiosynthesis; the maximum radiochemical yields obtained had the following values: G (Lauths' violet) = 1.65 and G (methylene blue) = 1.75. The influence of variously substituted aminated products on the radiochemical yield showed the possibility of synthesising Bindschedlers green and Wursters blue by radiochemical methods. The discovery of a fundamental intermediate product, Wursters red, together with the kinetic study of the chemical synthesis of methylene blue made it possible to determine the main stages of the reaction mechanism and to decide which of these stages could be attributed to ionizing radiations in the case of the radiochemical synthesis. (auth)

23709 (JINR-P-957) IZUCHENIE VZAIMODEISTVIYA GAZOOBRAZNYKH $ZrCl_4$, $HfCl_4$, $NbCl_5$, $TaCl_5$ S KCl S POMOSHCH'YU RADIOAKTIVNYKH INDIKATOROV. (Applications of Radioactive Indicators in Studies of Interactions of Gaseous $ZrCl_4$, $HfCl_4$, $NbCl_5$ and $TaCl_5$ with KCl). I. Zvara and L. K. Tarasov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1962. 12p.

Radioactive indicators were used to study the interaction of Zr, Hf, Nb, and Ta chlorides with potassium chloride. The vapors of labeled chlorides in the stream of a carrier gas were passed through a tube filled with KCl with a known temperature gradient maintained. The radioactivity distribution along the tube was measured. The temperature dependence of the vapor pressure of the chlorides over their double compounds with KCl in a comparatively low temperature range was obtained. (auth)

23710 (JLI-650-2-1(Vol.I)) TRAINING EXPERIMENTS IN RADIATION CHEMISTRY. VOLUME I. EXPERIMENTS DEVELOPED FOR U. S. ATOMIC ENERGY COMMISSION, DIVISION OF ISOTOPES DEVELOPMENT. (Johnston (William H.) Labs., Inc., Baltimore). June 1960. Contract AT(11-1)-650. 171p.

A series of experiments and ideas relative to the broad area of radiation chemistry is presented. The 10 experiments are interaction of alpha particles with matter, interaction of electrons with matter, interactions of gamma rays with matter, Fricke dosimeter, gas-liquid chromatography and chemical effects of radiation, radiolysis of water and de-colorization of methylene blue, radiolysis of methane, polymerization of styrene, sol-gel cultures and radiation damage to living cells, and viscometric determination of the radiation degradation of polymethyl methacrylate in solution. Apparatus needed for the experiments is discussed. (M.C.G.)

23711 (JLI-650-2-1(Vol.II)) TRAINING EXPERIMENTS IN RADIATION CHEMISTRY. VOLUME II. THEORY DEVELOPED FOR U. S. ATOMIC ENERGY COMMISSION, DIVISION OF ISOTOPES DEVELOPMENT. (Johnston (William H.) Labs., Inc., Baltimore). June 1960. Contract AT(11-1)-650. 124p.

The basic theory for experiments given in volume I is presented. Topics covered include interactions of alpha particles, beta particles, x and gamma rays, absorbance and total dose, and ion-molecule reaction cross sections. A reprint of the Lind Jubilee Symposium on the Development of Radiation Chemistry is included. (M.C.G.)

23712 (NP-11744) ACTIVIDADES DE RADIOISÓTOPOS PRODUCIDOS POR IRRADIACIONES INTERMITENTES. INFORME NO. 62. (Activities of Radioisotopes Produced by Intermittent Irradiations. Report No. 62). Juan Flegenheimer and Yizhak Marcus (Argentina. Comision Nacional de Energía Atómica, Buenos Aires). 1962. 8p.

A graphical method is proposed which facilitates the calculation of the specific activity obtained at the end of a period of successive cycles of irradiation and cooling. The specific activity obtained for irradiation to saturation, A_∞, is given by: $A_\infty = 0.163\ \sigma f a/M$ curies/g, where σ is the effective cross section of the activation in barns, f is the neutron flux in 10^{12} n/cm^2 sec, a the percentage of isotopic abundance, and M the atomic weight of the element. (B.O.G.)

23713 (NP-11788) ELECTRIC QUADRUPOLE SPLITTING AND THE NUCLEAR VOLUME EFFECT IN THE IONIC COMPOUNDS OF IRON 57. Technical Report No. 2. Robert Lynn Ingalls (Carnegie Inst. of Tech., Pittsburgh). May 1, 1962. Contract Nonr-760(2). 89p.

Mössbauer spectra were observed in a number of divalent and trivalent Fe^{57} ionic compounds at temperatures ranging from 77 to 300°K. Relative energy shifts of the spectra, characteristic of the particular type of iron ion under investigation, indicate that the charge radius of the Fe^{57} nucleus is greater in the ground state than in the first excited state. These spectral shifts, when compared to that for the iron atom, indicate that the electron density at the iron nuclei in metallic iron is equivalent to the electron configuration $3d^7 4s^1$. In addition, the ferrous data clearly show pure electric quadrupole splitting. To interpret the data quantitatively, Sternheimer polarization factors for the ferrous ion are computed and the quadrupole moment for the first excited state of Fe^{57} is estimated to be 0.15 barn. A simple model is also suggested to explain the striking temperature dependence of the quadrupole splitting in the ferrous compounds. (auth)

23714 (NYO-10023) THE EFFECT OF ELECTROPHILIC ADDITIVES ON THE RADIOLYTIC PRODUCTS OF ORGANIC CHAIN REACTIONS. Quarterly Report, February 1962–April 1962. (Little (Arthur D.) Inc., Cambridge, Mass.). June 15, 1962. Contract AT(30-1)-2904. 12p.

The radiation-induced reactions of propylene and isobutane adsorbed on transition metal oxide modified silica gel surfaces were examined. The effect of initial hydrocarbon composition on the radiolytic yield is noted. The radiolysis of isobutane adsorbed on SiO_2, Fe_2O_3–SiO_2 and NiO–SiO_2 was also examined. There is a striking difference in the pattern of these results when compared with the results obtained with the paraffin-olefin mixtures on these surfaces. (auth)

23715 (PAN-285/ChR) ON RADICAL INITIATED CHAIN OXIDATION OF IRON(II) IN AIR SATURATED ACID SOLUTIONS CONTAINING ALCOHOLS. PART I. ANALYSIS OF THE FINAL VALUE $G(Fe^{3+})$ IN THE PRESENCE OF C_2H_5OH. Lech Stolarczyk (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Dec. 1961. 10p.

Air saturated solutions containing 2.5×10^{-4} to 2.5×10^{-3} M Fe^{2+}, 0 to 10^{-1} M C_2H_5OH, and 0.4 M H_2SO_4 were irradiated by single electron pulses of 0.8 Mev. Aspects of the chain reaction mechanisms of iron(II) oxidation are discussed. The final concentration of Fe^{3+} was not higher than 10 to 15% of the initial concentration of Fe^{2+} and C_2H_5OH, so the concentrations of Fe^{2+} and C_2H_5OH were taken approximately as constants for the given chain process. It was found that a linear relation exists between $G(Fe^{3+})$ and the concentration of C_2H_5OH and a hyperbolic one between $G(Fe^{3+})$ and $[Fe^{2+}]$. (P.C.H.)

23716 (PAN-290/ChR) DETERMINATION OF RADIATION YIELDS IN THE TWO-PHASE SYSTEM OF $O_2(g)$–H_2O, NaOH, Na_2SO_3(l). Zbigniew P. Zagórski, Zbigniew Kecki, and Henryk Wincel (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Dec. 1961. 9p.

The yields of hydrogen in the γ irradiated two-phase system of an aqueous solution of Na_2SO_3 and NaOH with oxygen above solution were determined, as well as the yields of sulfite and oxygen consumption, confirming the stoichiometry of 2 SO_3^{2-} per O_2. (auth)

23717 (USNRDL-TR-565) THE SELF-RADIATION OXIDATION OF TRITIUM IN OXYGEN AND AIR. G. J. Casaletto, L. H. Gevantman, and J. B. Nash (Naval Radiological Defense Lab., San Francisco). May 8, 1962. 25p.

The rate of self-radiation oxidation of tritium was studied in atmospheres of O and air by direct analysis of products as a function of time. Second-order dependence on tritium concentration was observed below 1 mc/ml. Rate constants were determined to be 1.2×10^{-3} ml/mc-hr in O and 0.62×10^{-3} ml/mc-hr in dry air. The reaction rate was found to be independent of O concentration and surface area at constant total pressures above 100 mm but to drop off sharply below this value. The rate in O is increased threefold in the presence of water vapor. The rate in atmospheric air, although poorly reproducible, is essentially the same as in dry air. (auth)

23718 (AEC-tr-4321) GRAFT POLYMERIZATION OF POLYETHYLENE BY γ-RAY. Masatosi Miura, Syunzi Kawamatsu, Osamu Nakada, and Tadaaki Hirai. Translated from a paper presented at the Third Japan Conference on Radioisotopes held in Tokyo, September 14-16, 1959. 13p.

The grafting reaction and the properties of graft copolymers in the graft polymerization process, in which polyethylene was grafted with styrene or acrylonitrile (AN) by γ radiation either through the immersion technique or through the vapor phase technique, were studied. When styrene was used, the immersion technique resulted in a decrease of the grafting rate with the irradiation time, but in the vapor phase technique, the grafting rate increased during the early part of the irradiation time. With AN, the grafting rate increased with irradiation time in both techniques. When styrene is used, higher tensile strength was obtained by the vapor phase technique. This is due probably to the uniformity of the grafted film. With AN, higher tensile strength was obtained by the immersion technique. Divinyl benzene added to styrene for graft polymerization increased the gel content considerably. (P.C.H.)

23719 (AEC-tr-5093) THE CHEMICAL EFFECTS OF THE (n,p) REACTION: NEUTRON IRRADIATION OF THE CHLOROBENZENE–BENZENE SYSTEM. K. Panek and L. Slama. Translated from p.209-11 of "Chemical Effects of Nuclear Transformations. Proceedings of a Symposium, Prague, October 24-27, 1960. Vol. II" (a publication of the International Atomic Energy Agency, 1961. (STI/PUB/34 (Vol.II)(p.209-11)). 5p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11758.

23720 (AEC-tr-5144) THE CROSS-LINKING OF PTFE (TEFLON) AND OTHER POLYMER MATERIALS BY THE LOCALIZED ACTION OF NEUTRON IRRADIATION. V. I. Gol'danskii, I. M. Barkanov, B. G. Dzantiev, and E. V.

Egorov. Translated from p.363-9 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. II." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/34(Vol.II(p.363-9))). 10p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11772.

23721 (AEC-tr-5149) THE USE OF CHEMICAL CHANGES ACCOMPANYING BETA-DECAY OF RaE FOR THE SYNTHESIS OF ORGANIC COMPOUNDS OF POLONIUM. A. N. Murin, V. D. Nefedov, V. M. Zaitsev, and S. A. Grachev. Translated from p.183-7 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. II." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/34(Vol.II(p.183-7))). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11755

23722 (AEC-tr-5150) A STUDY OF ISOTOPE EFFECTS IN BETA-DECAY OF NATURAL ISOTOPES OF LEAD. V. D. Nefedov, Yu. A. Ryukhin, M. A. Toropova, V. N. Mel'nikov, and Li Chih-Min. Translated from p.149-55 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. II." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/34(Vol.II (p.149-55))). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11752.

23723 (AEC-tr-5151) ISOTOPE EFFECT AND SECONDARY REACTIONS OF BROMINE RECOIL ATOMS ACCOMPANYING THE (n,γ) PROCESS. A. N. Nesmeyanov, E. S. Filatov, E. A. Borisov, and B. M. Shukla. Translated from p.259-76 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. II." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/34(Vol.I(p.259-76))). 23p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 6483.

23724 (AEC-tr-5153) THE COMBINED EFFECT OF RADIATION AND CATALYST. Ya. K. Syrkin and I. N. Godnev. Translated from Zhur. Fiz. Khim., 5: 32-7(1934). 12p.

Kinetics of the combined effect of a platinum sol and ultraviolet radiation on the decomposition of hydrogen peroxide in solution were investigated at 19.5, 29, and 38°C. The energy increment from the Arrhenius equation was about 7700 to 8000 cal in both cases. The decomposition of peroxide on colloidal platinum was satisfactorily represented by a Langmuir absorption equation. (P.C.H.)

23725 (AEC-tr-5155) REACTIONS OF POSITIVE IONS WITH MOLECULES IN THE GAS PHASE IN THE RANGE $3 \times 10^{-3} - 10^{+2}$ ev. V. L. Tal'roze. Translated from p.103-12 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. I." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/34(Vol.I(p.103-12))). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 6473.

23726 (JPRS-14324) FIVE YEARS OF WORK AT THE RADIOCHEMICAL LABORATORY OF THE RESEARCH INSTITUTE FOR HEAVY CHEMICAL INDUSTRY. Andor Almasy and Sandor Orsos. Translated from Magyar Ken. Lapja, 17: No. 2, 71-3(Feb. 1962). 8p.

The history and major activities of the Radiochemical Laboratory of the Research Institute for Heavy Chemical Industry at Veszprem, Hungary are reviewed over the first five years. Emphasis is placed on the application of radioisotopes and radiochemical methods in analysis, scientific research, and chemical plants. The research program is also discussed. (N.W.R.)

23727 THE EFFECT OF ENERGETIC RADIATION ON ORGANIC MONOMERS AND POLYMERS. H. J. Rang. Atoomenergie, 4e: 25-33(Feb. 1962). (In German)

The utilization of radiation for polymerization is discussed. The results of the interaction of radiation with polymers are then reviewed. This interaction provides a new tool for the better comprehension of polymer structure and gives the possibility of altering the properties of polymers to satisfy specific industrial needs. (tr-auth)

23728 THE USE OF RADIONUCLIDES AND NUCLEAR RADIATION IN PROCESSING. H. Ramdohr. Aufbereitungs-Tech., 1: 349-53(Aug. 1960).

A survey is given of the numerous possibilities for the use of radioactive nuclides and nuclear radiation in chemical engineering and especially in processing. A difference is made between the use of enclosed sources of radioactive radiations, which is more frequently realized, and the application of open products. In the use of enclosed sources, 3 physical effects can be exploited: attenuation and reverberatory scattering of β and γ radiation, slowing down of neutrons by hydrogen, and production and attenuation of deceleration radiation. Nearly in all cases, the investigations made with open products concern the measuring of the distribution or of the direction of migration of the radioactive substance within the inactive material, by means of the β- or γ-radiation emitted by the former. A further possibility, which may prove useful, is the amelioration of the processing properties of won materials, by means of nuclear radiation. (OID)

23729 THE ALKALINE HYDROLYSIS OF S-ADENOSYLMETHIONINE IN TRITIATED WATER. F. Schlenk and J. L. Dainko (Argonne National Lab., Ill.). Biochem. Biophys. Research Communs., 8: 24-7(June 19, 1962).

A mechanism for alkaline hydrolysis of S-adenosylmethionine suggested by Frank et al in which an ethylenic intermediate with the double bond at carbon atoms 4 and 5 of the ribose was confirmed with experiments in tritiated water. (M.C.G.)

23730 ABSOLUTE YIELDS IN THE γ-RADIOLYSIS OF GASES. R. A. Back, T. W. Woodward, and K. A. McLauchlan (National Research Council of Canada, Ottawa). Can. J. Chem., 40: 1380-4(July 1962).

Absolute yields of hydrogen from the γ-radiolysis of hydrocarbon gases were obtained by relating the hydrogen produced to saturation ion currents measured in the radiolysis vessel. Values for G_{H_2} of 1.28, 1.20, 6.25, 5.40, and 5.00 were estimated for ethylene, propylene, propane, n-butane, and isobutane respectively. These values are consistently lower than those obtained previously with α rays, and this is discussed as an effect of radiation quality. Arguments are advanced for the use of M/N, the yield per ion pair, rather than G, as a measure of yields in the radiolysis of gases. (auth)

23731 HYDROGEN FORMATION IN γ-IRRADIATED HYDROGEN CHLORIDE. D. A. Armstrong (Univ. of Alberta, Calgary, Can.). Can. J. Chem., 40: 1385-93 (July 1962).

Hydrogen yields from pure liquid and solid hydrogen chloride irradiated with Co_{60} γ rays were G_{H_2} (liquid) =

6.50 ± 0.10 and G_{H_2} (solid) = 3.30 ± 0.10 at −79 and −196°C respectively. The yield from solid hydrogen chloride was only slightly reduced by the addition of chlorine; but the yield from liquid samples was reduced sharply by low concentrations of chlorine to a value of about 4.5, and then much more gradually by larger concentrations. A G_{H_2} value of 2.1 persisted at 10 mole% chlorine. The results were interpreted in terms of the formation of hydrogen in the reactions H + HCl → H_2 + Cl [11] and H (hot) + HCl → H_2 + Cl. [11*]. Reduction of the hydrogen yields by chlorine was attributed to the reactions H + Cl_2 → HCl + Cl [15] and H (hot) + Cl_2 → HCl + Cl. [15*]. Values of k_{11}/k_{15} and k_{11}^*/k_{15}^* were estimated to be 1.7×10^{-3} and 0.10 respectively, while those of G_{H_2} and $G_{H(hot)}$ were 2.4 ± 0.2 and 4.0 ± 0.2. Electron scavenging by chlorine was considered as a less likely mechanism for reduction of the hydrogen yield. Sources of the thermal and hot hydrogen atoms were examined and it was suggested that the decomposition of electronically excited molecules might be an important mode of decomposition. (auth)

23732 CHEMICAL DOSIMETRY OF GAMMA RAYS, NEUTRONS, AND ACCELERATED ELECTRONS. Cemil B. Senvar. Communs. faculté sci. univ. Ankara, 8: 12-23 (1960).

A ferrous sulfate dosimeter solution was irradiated in pyrex glass capsules from several laboratory Co^{60} sources. The results are plotted in a graph. The standardized sources were then used to determine the effect of formic acid as an organic impurity on the ferrous sulfate dosimeter. (OID)

23733 EFFECTS OF IONIZING RADIATION AND THERMAL TREATMENTS ON THE FATE OF RADIOBROMINE PRODUCED BY RADIATIVE NEUTRON CAPTURE IN SOLID ORGANIC BROMIDES. Kenneth Elmer Collins (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 3421-2(Apr. 1962).

The effects of ionizing radiation and thermal treatments on the chemical fate of Br^{82} atoms produced in solid C_2Br_6 by the $Br^{81}(n,\gamma)Br^{82}$ process and the effects of thermal treatments on the fate of Br_2 produced in solid C_2Br_6 by ionizing radiation were investigated. The work was designed to clarify and extend the available information on the nature of radiation annealing and thermal annealing processes of radiohalogen atoms produced by the (n,γ) process in solid organic halides. The chemical fate of Br^{82} atoms was measured by two types of determinations; the aqueous yield (the percentage of the Br^{82} activity extractable into the aqueous phase from a solution of the crystals in an organic solvent) and the evaporation yield (the percentage of Br^{82} activity evaporating from a solution of the crystals in liquid bromine). The results indicate that the aqueous extractable Br^{82} was in the chemical form of Br_2 and that the activity which remained in the residue crystals after the bromine evaporation was in the form of C_2Br_5. Thermal annealing appears to have occurred by the reaction of $BrBr^{82}$ with neighboring radicals or C_2Br_6 molecules to produce $C_2Br_5Br^{82}$. An additional unidentified fraction of the Br^{82} evaporated with Br_2 but did not extract into the aqueous solution. As much as 10^{20} ev g^{-1} of ionizing radiation from a Co^{60} source, given either before or after neutron activation, did not appreciably alter the amount of aqueous extractable Br^{82} from neutron irradiated C_2Br_6 if the samples were maintained at −196°C until analysis. However, ionizing radiation did affect the aqueous yield if given at 0°C after the neutron irradiation. Exposure to ionizing radiation either before or after neutron irradiation at −196°C or at 0°C affected the subsequent thermal annealing of the aqueous extractable Br^{82} species. These facts indicate that transitory intermediates produced by the gamma radiation can affect the fate of Br^{82} present in the crystal and that relatively long-lived effects produced by the gamma irradiation are retained in the crystal and can migrate to affect the Br^{82} when the crystal is heated. At least six different thermal annealing processes which reduced the aqueous yield were shown to occur in C_2Br_6 which had been irradiated with neutrons at −196°C. One of these which involved at least 27% of the Br^{82} activity, was complete within several seconds at 0°C and was independent of prior Co^{60} irradiation of the C_2Br_6. The other five processes were indicated by analysis of kinetic data from isothermal annealing experiments at temperatures from 0 to 100°C. One of these, occurring at 100°C but not at 76.5°C was a second order process which was insensitive to a 40-fold variation in absorbed dose of ionizing radiation. It is tentatively concluded that this process involved combinations of fragments within the (n,γ) produced defects. Bromine was produced by Co^{60} irradiation of C_2Br_6, the G-value being 0.3 molecules per 100 ev for an absorbed dose of 10^{20} ev g^{-1}. Thermal annealing caused the Br_2 to return to organic combination at rates similar to those observed for the thermal annealing of Br^{82} produced in the crystals by the (n,γ) process. Thermal treatments at 45°C, 64.5°C and 76.5° resulted in the decrease of $G(Br_2)$ to a plateau value of 0.09.

23734 EFFECTS OF POST-IRRADIATION TREATMENT ON THE CHEMICAL EFFECTS OF THE NUCLEAR TRANSFORMATION $N^{14}(n,p)C^{14}$ IN CRYSTALLINE AMMONIUM CHLORIDE. Pierre J. Marteney (Univ. of Illinois, Urbana). Dissertation Abstr., 22: 3426(Apr. 1962).

Irradiation of ammonium chloride with thermal neutrons produces the nuclear transformation $N^{14}(n,p)C^{14}$. The carbon archekine is born with an energy of 45 kev. From the standpoint of the intact crystal lattice in which it is produced, the carbon recoil atom is a moving atom. Moving atoms produce ionization and displacement as they are slowed down by interactions with the constituent atoms of the lattice. There are a number of small volumes in which energy is dissipated. The physical model built up concerning the dissipation of energy of moving atoms in solids under radiation was used to estimate the spatial distribution of the radiocarbon. According to this model, the archekine forms one or more temperature spikes, small, short-lived zones of local excitation, in coming to rest. It may react within a spike, or it may traverse the lattice and form more spikes. If it fails to form more spikes, it may react with the lattice through replacement of lattice atoms. Chemical combinations can persist only when the energy of the archekine has fallen to the order of 5 to 10 ev. Regardless of the method of energy loss, the energy of the medium immediately surrounding the archekine must be at this energy level, or the combination can not persist. This may lead to competitive reactions in the more energetic zone, termed the displacement spike. Zones of lesser energy are termed thermal spikes. The distribution of radiocarbon over various chemical forms was determined. For this investigation, gas phase chromatography was used to separate the various carbon-containing fractions. The radiometric determinations were performed concurrently with the chromatographic separations, using a flow ionization chamber. The chromatographic column was a double helical tube packed with Sil-O-Cel covered with tricresyl phosphate. The sensing elements used in the chromatographic apparatus were thermistors. Radiometric measurements were performed upon the eluent from the column.

The eluent passed into a flow ionization chamber of small volume. The activity was sensed by passing the ionization current into a vibrating reed electrometer. The distribution of radiocarbon found using the above method agrees with work performed previously by wet-chemical analysis. Additional investigations involved the resublimation of the target material in the presence of oxygen, hydrogen, and ammonia at pressures of 5 to 10 mm. The purpose of these treatments was to determine the persistence of the compounds formed in the target during irradiation, for comparison with the compounds found after solution in water of non-resublimed target material. The ultimate distribution of the radiocarbon is relatively insensitive to the treatment given the irradiated sample. The reactions which the archekine probably undergoes were analyzed in terms of the three modes of energy loss: formation of a displacement spike, formation of a thermal spike, and direct replacement of lattice atoms. Several paths may lead to the same compound, and reactions with water of the compounds or radicals containing the archekine at the time of solution were discussed. Some of the compounds formed can not form in the crystal, because oxygen is not present in the crystal. They must be the result of solvent interactions with the complexes containing the recoil carbon. The model presented for the chemical and physical interactions of the archekine with the lattice was used to estimate the distribution of radiocarbon in ammonium chloride. The result was an accounting for at least 80% of the activity. The model was applied to beryllium nitride, ammonium bromide, and ammonium sulfate, with equal success. Thus, it appears that the several physical processes occur in approximately the same distribution in very different crystals and are not strongly dependent upon the nature of the target, and that no chemical effects occur before the recoil atom is completely stopped in the lattice.

23735 IRON SULFATE DOSIMETRY OF GAMMA RADIATION. Preston Vincent Murphy. Fóton, 1: No. 11-13, 1-4(Oct.-Dec. 1959).

A study was carried out on the chemical dosimetry of γ radiation. This method is based upon the oxidation of ferrous sulfate to ferric sulfate and allows the measurement of radiation doses from 4000 to 40,000 r with an accuracy of 2%. A 1.5 to 2.0×10^{-4} M solution of $FeSO_4(NH_4)_2SO_4$. H_2O was used which was stabilized with 10^{-3} M NaCl and 0.4 M H_2SO_4. The quality of oxidized iron can be determined exactly by combining the residual non-oxidized iron with orthophenanthroline to the complex compound ferrous-triorthophenanthroline (ferroine), and the optical density can be measured with the Beckman spectrophotometer. If D is the optical density and d is the distance traversed through the solution by the γ rays, then the radiation dose can be determined from the molar extinction coefficient by the formula, $\epsilon = D/d[Fe^{2+}]$. Various graphs show the dependence of the optical density on (a) pH, (b) the amount of complex formed, and (c) the dilution. A table shows the extinction coefficient at various distances from a 2100-c Co^{60}. The results of the measurements were extremely satisfactory in spite of the inclement climate in which they were carried out, i.e., high temperature and humidity. (DCH)

23736 ON THE INDIRECT APPLICATION OF RADIOACTIVE NUCLEI IN ANALYTICAL CHEMISTRY. PART II. B. C. Parkayastha and V. R. Pai Verneker (Saha Inst. of Nuclear Physics, Calcutta). J. Indian Chem. Soc., 39: 180-4(Mar. 1962). (In English)

Sc^{46} was used to examine the validity of methods for estimating scandium. The method, based on the precipitation of scandium as hydroxide and its subsequent ignition, was found to be a dependable one. Scandium even in sulfuric acid medium undergoes complete hydrolysis when boiled with a mixture of iodate and iodide. The iodine liberated in the process can be collected and estimated either by hypo titration or by radiometric method with I^{131}. In case of radiometric procedure, up to 0.09 mg scandium, can be estimated with a fair degree of accuracy. Using labeled pyrophosphate ($Na_4P_2^*O_7$) scandium was estimated up to 0.9 mg within statistical fluctuation. Rare earths do not interfere in the estimation of scandium as pyrophosphate. (auth)

23737 EFFECTS OF CUPRIC SALTS ON THE POLYMERIZATION OF ACRYLONITRILE IN AQUEOUS SOLUTION. Masamoto Watanabe and Hiroshi Kiuchi (Toyo Rayon Co., Ltd., Otsu, Japan). J. Polymer Sci., 58: 103-19(Apr. 1962).

The polymerization of acrylonitrile in aqueous solution initiated by ammonium persulfate or gamma radiation in the presence of cupric salts was studied by a dilatometric method. The presence of cupric sulfate, nitrate, or acetate has a pronounced effect on polymerization, leading to an increase in the rate, and both cupric chloride and bromide retard or inhibit polymerization beyond certain salt concentrations. The increased rate is explainable by the following reactions: $CH_2 = CHCN + Cu^{2+} \rightarrow CH_2 = \dot{C}CN + Cu^+ + H^+$ and $Cu^+ + S_2O_8^{2-} \rightarrow SO_4^- + SO_4^{2-} + Cu^{2+}$. The polymerization of acrylonitrile can be initiated by an oxidizing agent such as cupric sulfate, ferric sulfate, stannic chloride, nitric acid, or periodic acid. The decreased rate can be explained by assuming that the complexes of Cu^+ ion with a halide ion X^- such as CuX_2^-, CuX_3^{2-}, CuX_4^{3-}, or $Cu_2X_3^-$ shows lower reactivity in the reaction with $S_2O_8^{2-}$. The cupric-terminated reaction depends on the coexisting anion. The effect of sulfate, nitrate, acetate, phosphate, chlorate, or fluoride anions is negligible, while that of the chloride is marked, and that of the bromide is overwhelming. The CuX^+X = Cl, Br ion appears to terminate polymer chains more efficiently than does Cu_{aq}^{2+}. Apparent transfer constants of cupric sulfate in the presence of sodium chloride or bromide and the transfer constant of $CuCl^+$ are given. It is suggested that the possibility of the termination reactions by halogen atom transfer is large under conditions of high halide ion concentration:

$$\sim CH_2\dot{C}HCN + CuX^+ \rightarrow \sim CH_2\underset{\displaystyle X}{\underset{|}{C}}HCN + Cu^+$$

and

$$\sim CH_2\dot{C}HCN + CuX_2 \rightarrow \sim CH_2\underset{\displaystyle X}{\underset{|}{C}}HCN + CuX. \text{ (auth)}$$

23738 BEHAVIOR OF PRIMARY RADICALS IN VINYL POLYMERIZATION. Tomonobu Manabe, Tadashi Utsumi, and Seizo Okamura (Kyoto Univ.). J. Polymer Sci., 58: 121-46(Apr. 1962).

Equations are derived for the relation between the rate and the viscosity-average degree of polymerization and for the concentrations of primary radicals and chains. Results are reported for experiments in which polymerization of styrene was initiated by azobisisobutyronitrile (bulk and solution) and by radiation (solution). (D.L.C.)

23739 COPOLYMERIZATION STUDIES OF RADIATION-INDUCED POLYMERIZATION AT LOW TEMPERATURE. Yoshizo Tsuda (Toyo Rayon Co., Ltd., Otsu, Japan). J. Polymer Sci., 58: 289-97(Apr. 1962).

Copolymerization of acrylonitrile with styrene or methyl methacrylate was performed by gamma irradiation at low

temperatures in various solvents. Both an anionic copolymerization and a free-radical reaction were observed to proceed simultaneously. However, when water, alcohol, or ester is present, the anionic polymerization is inhibited. On the other hand, when the content of styrene increases, the free-radical polymerization is retarded. From results of the fractionation of styrene–acrylonitrile copolymer obtained, it was concluded that an anion-radical of acrylonitrile formed by irradiation at low temperatures initiates both an anionic and a free-radical copolymerization. The resultant copolymer consists of a block of anionic copolymer attached to a block of free-radical copolymer. (auth)

23740 POLYMERIZATION INDUCED BY IONIZING RADIATION AT LOW TEMPERATURES. I. EVIDENCE FOR THE SIMULTANEOUS EXISTENCE OF IONIC AND FREE-RADICAL MECHANISMS IN THE POLYMERIZATION OF STYRENE AND 2,4-DIMETHYLSTYRENE. Catherine S. Hsia Chen and Robert F. Stamm (American Cyanamid Co., Stamford, Conn.). J. Polymer Sci., 58: 369–88(Apr. 1962).

By means of initiation with ionizing radiation, styrene and 2,4-dimethylstyrene were polymerized in the crystalline solid state, in the pure liquid state, and in solution at different temperatures (–80 to 25°C). In solution polymerization, it was found that for the same type of initiation, other conditions being constant, the mechanism by which these monomers polymerize is temperature-dependent. At lower temperatures a cationic mechanism predominates; at higher temperatures a free-radical mechanism is in the ascendancy. At intermediate temperatures, both cationic and free-radical polymerizations take place. Furthermore, these intermediate temperatures are different for different monomers, being higher in a monomer whose electronic structure is more favorable for cationic polymerization. The difference in mechanism at different temperatures has been proved by: (1) the dose rate dependencies, both of the polymerization rates and of the molecular weights of the resulting polymers; (2) the activation energies for the polymerization; and (3) the relative reactivities in the polymerizations of styrene and substituted styrenes. (auth)

23741 POLYMERIZATION INDUCED BY IONIZING RADIATION AT LOW TEMPERATURES. II. EFFECTS OF CHANGE OF PHASE AND HETEROGENEITY ON THE POLYMERIZATION OF STYRENE AND 2,4-DIMETHYLSTYRENE. Catherine S. Hsia Chen (American Cyanamid Co., Stamford, Conn.). J. Polymer Sci., 58: 389–409(Apr. 1962).

The radiation-induced polymerizations of undiluted styrene and of 2,4-dimethylstyrene were studied in the solid, partially solid, and completely liquid states. The results may be compared with solution polymerizations covering a similar temperature range reported in the previous paper. In addition to the interesting information obtained from the rate data for the solid phase, decidely unusual effects of temperature on rate were found by studying the systems in the vicinities of the melting points. For styrene, in the solid state (below –30.5°C), the rate increases with temperature (ΔE_a = 6 to 7 kcal/mole), having a maximum value when the system is partially solid. The rate drops rapidly above the melting point to a minimum and then rises in a normal manner with temperature (ΔE_a = 9 to 10 kcal/mole). For 2,4-dimethylstyrene, in the solid monomer (–120 to 65°C), the rate increases with temperature (ΔE_a = 1 kcal/mole), having, like styrene, a maximum value at the melting point where the system is a solid-liquid mixture. The rate drops precipitously above the melting point. In the liquid state, the rate also increases with temperature (ΔE_a = kcal/mole). Similar effects were observed in the polymerization of styrene–benzene and styrene–ethylbenzene mixtures. Enhanced rates were observed at the melting temperatures of these mixtures. (auth)

23742 γ-RADIATION OF p-SUBSTITUTED POLYSTYRENES. W. Burlant (Ford Motor Co., Dearborn, Mich.), J. Neerman, and V. Serment. J. Polymer Sci., 58: 491–500(Apr. 1962).

The electronic environment about the main chain atoms in polystyrenes was varied systematically by introducing electronegative or electropositive substituents (H_3C–, CH_3O–, Br–, Cl–, NC–, and O_2N–groups) in the p-position of the ring. Energy yields for γ-initiated H_2 formation and crosslinking, both a measure of the radiation sensitivity of the backbone, were determined above and below T_g from (1) mass spectrometric examination of the decomposition gases and (2) molecular weight changes. For most of the polymers, it is concluded that the backbones of p-substituted polystyrenes are more radiation stable than that of polystyrene, and that main chain macroradicals formed early in the reaction are responsible for the major changes observed, i.e., hydrogen evolution and crosslinking. The role of the p-substituent on the latter effects is interpreted qualitatively in terms of the contribution by the substituent to the resonance stability of these intermediate polymer radicals. In the case of poly-p-bromo- and poly-p-chlorostyrene, the inordinately high sensitivity to crosslinking and the absence of halogen atoms in the decomposition gases suggest the importance of a chain reaction in the radiation chemistry of these molecules. (auth)

23743 EXAMINATION OF KINETICS OF THERMAL DECOMPOSITION OF PEROXIDES OF POLYMETHYL METHACRYLATE. E. Turska and S. Połowiński (Politechnika Zodzka, Łodź, Poland). J. Polymer Sci., 58: 839–42(Apr. 1962).

The kinetics of thermal decomposition of the peroxides obtained by γ irradiation of polymethyl methacrylate in air was investigated. The method of examination of the velocity of this reaction was based on the reaction of DPPH with free radicals. The measurements resulted in finding the reaction to be of the first order. The rate constants for the thermal decomposition of the peroxides at temperatures of 70, 80, 90, and 100°C were determined. The constants for the Arrhenius formula were determined and the relationship $k = 3.61 \times 10^5 e^{-4} e^{-15,000/RT}$ was found. (auth)

23744 RADIATION-INDUCED SOLID-STATE POLYMERIZATION OF RING COMPOUNDS. Seizo Okamura, Koichiro Hayashi, and Yasuhisa Kitanishi (Japanese Assn. for Radiation Research on Polymers, Osaka). J. Polymer Sci., 58: 925–53(Apr. 1962).

Ring compounds such as trioxane, β-propiolactone, diketene, and 3,3-bischloromethylcycloxabutane can be polymerized only in the solid state by γ radiation. These ring compounds polymerize by a ring-opening, ionic mechanism to highly crystalline, high molecular weight, linear polymers. In general, the conversion vs irradiation time curves reach a limiting value at relatively low yield. These saturation phenomena are due to the disruption of unreacted monomer lattice by the formed polymer. The polymers obtained from large-monomer crystals are found to have outward appearances of large crystals which suggest the monomer crystalline lattice has influenced that of the polymer. Moreover, the polymers from large crystalline monomer have higher polymerization rate and better orientation of the crystallites, as ascertained through x-ray

diffraction and polarizing microscopic analyses. Polarizing microscopic photographs of the polymers show birefringence clearly. These facts indicate that the structure of the monomer lattice directly imposes order and orientation upon the polymer. X-ray diffraction analyses show that the polydiketene chain has a spiral configuration and poly-β-propiolactone has a planar zigzag chain. Some consideration of the propagation mechanism in the crystalline state of 3,3-bischloromethylcycloxabutene, β-propiolactone, diketene, and trioxane is made. Investigations of the binary systems with β-propiolactone were carried out to determine the effects of additives upon the propagation mechanisms. (auth)

23745 INVESTIGATION OF THE MECHANISM OF RADIOLYSIS OF POLYMERS CONTAINING QUATERNARY ATOMS OF CARBON. A. N. Pravednikov, E. N. Teleshov, Shen-kan In, and S. S. Medvedev (Karpov Inst. of Physics and Chemistry, Moscow). J. Polymer Sci., 58: 1039-48 (Apr. 1962).

The initial act of interaction of radiation in a polymer, irrespective of its chemical structure, is abstraction of an electron with formation of a positive ion. Neutralization of this ion by the electron leads to the formation of an excited molecule which subsequently breaks up with formation of free radicals. The pattern of changes occurring in the structure of the polymer will evidently depend upon the stabilization mechanism of these radicals. The fact that up to now the process of crosslinking during the radiolysis of polymers containing quaternary carbon atoms (polyisobutylene, poly-α-methylstyrene) has not been observed as well as the available data concerning the pattern of temperature dependence of the destruction rate, make it possible to draw the conclusion that, in these polymers, due to steric hindrances, the radicals formed as a result of the abstraction of side groups or hydrogen atoms react with each other with the breaking of the backbone chain of the polymer molecule. A study of the radiolysis of copolymers of styrene with α-methylstyrene in a swollen state showed that, in this case, because of the absence of steric hindrances, the interaction between the polymer radicals and radicals formed from the solvent results in the insertion of the solvent molecules into the polymer chains (demonstrated by a tracer technique); in this case the rate of degradation is decreased. Data obtained during the study of the radiolysis of the mixture of low molecular radioactive polyisobutylene with the conventional high molecular polyisobutylene show that interaction of radicals formed during the radiolysis of this polymer represents a kind of a disproportionation reaction accompanied by a transferal of the low molecular groups from one polymer radical to another. (auth)

23746 EFFECTS OF HIGH SPEED ELECTRONS ON THE STRUCTURE OF POLYETHYLENE TEREPHTHALATE. N. A. Slovokhotova, G. K. Sadovskaya, and V. A. Kargin (Academy of Sciences, Moscow). J. Polymer Sci., 58: 1293-9(Apr. 1962).

Polyethylene terephthalate (PET) films were irradiated with high speed electrons in vacuo. Their infrared spectra, solubility, and degree of swelling in o-chlorophenol were measured as a function of the irradiation dose. The investigation showed that irradiation causes both crosslinking and degradation. In the absence of air, crosslinking predominates over chain scission. The irradiation dose required for crosslinking of PET by far exceeds that required for crosslinking of polystyrene. Irradiation of PET is accompanied by the formation of polyphenyl systems. The initial partly crystalline PET becomes completely amorphous on irradiation. Irradiation causes isomerization of $O(CH_2)_2O$ groups in the polymer chain from the trans to the gauche form. Isomerization of $O(CH_2)_2O$ groups under irradiation may be interpreted as indicating that a part of the ionizing radiation energy is dissipated and transformed into the thermal energy. (auth)

23747 THE POLYMERIZATION OF ALLYLSILANES BY CATALYSTS AND THE EFFECT OF RADIATION. A. V. Topchiev, N. S. Nametkin, and L. S. Polak (Inst. de la Synthèse Petrochimique, Moscow). J. Polymer Sci., 58: 1349-61(Apr. 1962). (In French)

The polymerization of acenylsilane hydrides was studied in the presence of initiators or catalysts and on irradiation by gamma photons and electrons. The copolymerization of these acenylsilane hydrides with alcohol and with acrylonitrile was also carried out. Some polymers and copolymers were formed with high yields and showed interesting physicochemical characteristics. Between 20 and 250°C the polymerization in the presence of initiators and under irradiation proceeds by a free-radical mechanism. In all the cases studied the polymerization could proceed in two ways: (a) following the allyl radical double bond, and (b) through utilization of the Si—H bond in the alcenylsilane hydride. The rate of polymerization increases with the number of allyl groups in the alcenylsilane hydrides and depends, in the case of the monoallylsilanes, on the nature of the substituents on the silicon atom. (auth)

23748 THE FUNDAMENTAL PROBLEMS OF HIGH POLYMER RADIATION CHEMISTRY. Pao-kung Ch'len. K'o Hsüeh T'ung Pao, No. 18, 548-54(Nov. 1960).

Problems encountered in the radiation stability of high polymer material, radiation crosslinkage and cracking, radiation polymerization of monomers, radiation linking of high polymers, and photochemistry are discussed with respect to their future peacetime applications. (OID)

23749 THE INITIATION OF IONIC POLYMERIZATION WITH IONIZING RADIATIONS. Michel Magat. Makromol. Chem., 35: 159-73(Jan. 1960).

It has been known for some years that polymerization induced by ionizing radiation at or above room temperature proceeds by way of radical mechanisms. The slowness of the ions in starting polymerization is explained by their short life time. It has been shown recently, however, that ionic polymerization may be observed at low temperatures and in certain solvents. A theory is proposed (based on the Platzman-Fröhlich mechanism of the energy scattering of epithermal electrons) which explains why and under which conditions the life time of the positive ions may be extended in order to produce ionic polymerization. A survey is given of the experimental results available to date and it is shown that they agree with the theory. (OID)

23750 THE PRODUCTION OF MODIFIED STARCHES FOR THE PAPER AND TEXTILE INDUSTRIES BY MEANS OF γ-RAYS. Maks Samec. Nova Proizvodnja, 11: 277-9 (1960).

Experiments on changes in the different starch species under the influence of γ rays showed that is possible to produce a soluble starch from the potato starch by means of the γ rays and without the influence of water, heat, or chemical agents. This soluble starch compared favorably with the best modified starches produced in industry. By increasing the doses of the rays, 60% of starch could be converted into dextrin. (OID)

23751 THE INITIATION OF THE PEROXIDATION REACTION BY IONIZING RADIATION. M. Klang and

A. Dragut. Rev. Chimie (Bucharest), 12: 387-92(July 1961).

Gamma radiation from a Co^{60} source was used to initiate the oxidation of hydrocarbons in the petroleum industry. Crude oil and also distilled kerosene consisting of 40 to 50% hydrocarbons with boiling points from 165 to 250°C were used as raw materials. Kerosene samples of 100 g, which were exposed to the radiation of a 45-c Co^{60} source, received a total dose of 2.88×10^{18} ev/g. Data are given to show the relation between γ dose received and the peroxide formed and the influence of temperature, the presence of catalysts, the degree of the raffinate, and the presence of impurities in the reaction. (OID)

23752 RADIATION EFFECTS ON HIGH POLYMERS. Yoneho Tabata and Yoshio Tamba. Sen-i Gakkaishi, 16: 66-73(Jan. 1960).

Irradiation effects on polyethylene, polystyrene, polyisobutyrene, polypropylene, polyacrylic ester, polyvinyl alcohol, polyvinyl chloride, polyacrylonitrile, polycaprolactam, alginic acid, and alginic acid soda are discussed. Tabulated data and chemical equations are given. (OID)

23753 THE PREPARATION OF ACRYLONITRILE-ALLYL ALCOHOL COPOLYMERIC FIBERS BY γ-RAY INDUCED COPOLYMERIZATION. Buei Hada. Sen-i Gakkaishi, 16: 810-12(Oct. 1960).

Homogeneous copolymerization of acrylonitrile-allyl alcohol was carried out by γ irradiation in concentrated salt solutions. The spinning solutions were obtained directly from the monomer mixture solutions. From these polymer solutions, acrylic fiber was obtained by spinning. The fibers obtained were superior in mechanical and dyeing properties. (OID)

23754 LUMINESCENCE OF QUARTZ AND QUARTZ GLASS PRODUCED BY γ-RADIATION. R. Fischer. Silikat Tech., 11: 453-4(Oct. 1960).

Fragments of rock crystal and optical quartz glasses were cut and ground to $20 \times 20 \times 4$ mm disks and irradiated with Co^{60} γ rays at a dose rate of 2×10^3 r. Since the irradiation lasted 10 hr, the total dose was about 2×10^6 r. The irradiated specimens were brought immediately in contact with the AGFA spectrographic plate, "Rapid Blue," by which the intensive luminescence could be recorded. The luminescence produced by γ radiation is of long duration and accompanied by a brown discoloration similar to that of smoked quartz. A detailed study of the photographic pictures revealed certain inhomogeneities which were greater in quartz glass than in quartz mineral. The appearance of luminescence was considered proof of the development of metastable conditions. (OID)

23755 KINETIC PROCESSES IN IRRADIATED SUBSTANCES. M. A. Mokul'skiĭ. Vysokomolekulyarnye Soedineniya 2: 119-29(Jan. 1960).

A theoretical treatment is presented of a previously proposed mechanism for the acceleration of kinetic processes by irradiation. It is believed that the anomalously large number of "hot" atoms in the irradiated substance is the probable cause of the acceleration. The possible concentration of the "hot" atoms was estimated. The effect of temperature, stress, and radiation intensity on the rate of kinetic processes was studied using the example of mechanical stress relaxation. Formulas were derived for the change in the time spectrum of relaxation in the dynamic modulus and in other properties of a body subjected to the action of a radiation field. (OID)

23756 THE EFFECT OF IONIZING RADIATION ON THE CHEMICAL STRUCTURE OF RUBBER-LIKE FLUORINE-CONTAINING POLYMERS. A. S. Novikov. Vysokomolekulyarnye Soedineniya, 2: 485-91(Apr. 1960).

The effect of ionizing radiation on the chemical structure of rubber-like fluorine-containing copolymers was investigated. The influence of medium on the process was elucidated. It is shown that on irradiation in air, double bonds of the type, $-CF=CF-$, $-CH=CF_2$ and $-CF=CF_2$, and the oxygen-containing groups, $-C(=O)H$, $-C(=O)OH$ and $-C(=O)R$ and $-OH$ are formed. On irradiation in a vacuum, double bonds of the type $-CF=CF_2$ appear in large amounts. The number of double bonds in the copolymer and the degree of crosslinking were found to depend upon its hydrogen content. On the basis of the experimental results, a mechanism is proposed for the formation of double bonds and radicals during irradiation of fluorine-containing copolymers, and the possibilities of the occurrence of degradation and structural processes are indicated. (OID)

23757 RADIATION POLYMERIZATION OF PHENYLACETYLENE. I. M. Barkalov. Vysokomolekulyarnye Soedineniya, 2: 1103-8(July 1960).

On irradiation of phenylacetylene with fast electrons, a yellow-colored polymer formed, which gave a narrow EPR signal. The radiochemical yield was 8 to 9 mol/100 ev. A kinetic study of the polymerization reaction, both in bulk and in solution, showed that the specific properties of polyphenylacetylene caused the proportionality between the rate of polymerization and the rate of initiation ($V \sim I$). A study of the EPR spectrum showed that in polyphenylacetylene there is considerable delocalization of the unshared electrons. Since the reactivity of such molecules diminishes with their length, there is no definite borderline between the chain propagation and termination processes. The proposed "fading" mechanism makes it possible to explain the V-I relationship and the low over-all activation energy. The specific characteristics of this type of reaction included an accelerating action of oxygen and a high energy transfer from the solvent to the phenylacetylene observed during polymerization in solution. (OID)

23758 THE CARBANIONIC MECHANISM OF POLYMERIZATION UNDER THE ACTION OF γ-RAYS. L. P. Mezhirova, A. P. Sheĭnker, and A. D. Abkin. Vysokomolekulyarnye Soedineniya, 3: 99-104(1961).

An investigation of the γ-ray-induced polymerization of acrylonitrile at $-78°$ in various solvents showed that polymerization did not occur in solvents with electron acceptor properties: ethyl chloride, acetonitrile, heptane, ethyl acetate, acetone, toluene, and propionitrile. At this temperature and at a dose rate of 128 rad/sec, the rate of polymerization of acrylonitrile was 2.1×10^6 in the "bulk," 1.57×10^6 in isopropylamine, 6.7×10^6 in triethylamine, 9.7×10^6 in dimethylformamide (the acrylonitrile concentration was 3.5 mol/l). The polymerization rate of acrylonitrile in triethylamide (3.5 mol/l) increased with a decrease in temperature from -50 to $-112°$ (dose rate of 118 rad/sec). The polymerization rate of acrylonitrile in dimethylformamide was proportional to the first power of its concentration. Acrylonitrile-styrene copolymers obtained at $-78°$ in dimethylformamide were enriched greatly in the nitrile component, r_1 (acrylonitrile) = 33, r_2 (styrene) = 0.005. The copolymerization rate of acrylonitrile and styrene at $-78°$ in dimethylformamide (monomer concentration 3.5 mol/l) diminished with the addition of styrene to the acrylonitrile. Under these conditions styrene did not polymerize. (OID)

23759 THE CHLORINATION OF ORGANOSILICON MONOMERS AND POLYMERS UNDER THE ACTION OF γ-RAYS. I. THE CHLORINATION OF LIQUID POLYPHENYL-METHYL SILOXANE AND OF POLYDIMETHYL SILOXANE RUBBER. THE INFRARED SPECTRA OF THE CHLORINATION PRODUCTS. R. V. Dzhagatspanyan. Vysokomolekuylyarnye Soedineniya, 3: 607-12(1961).

Samples of polydimethylsiloxane rubber (SKT) and polyphenylmethyl siloxane liquid (PPMS) were chlorinated under the influence of Co^{60} γ rays. With the addition of 63% chlorine to SKT, the reaction took place very rapidly, but the results depended upon the quality of the sample. With the addition of 59.5% Cl to PPMS, the aromatic ring was attacked first under the given conditions. In both cases chlorination took place at 0°C. (OID)

23760 A STUDY OF THE MECHANISM OF POLYMERIZATION BY RADIATION. I. THE MECHANISM OF CARBONIUM POLYMERIZATION OF ISOBUTYLENE AND STYRENE UNDER THE INFLUENCE OF GAMMA RADIATION. A. P. Shenker and A. D. Abkin. Vysokomolekulyarne Soedineniya, 3: 716-22(1961).

γ-Ray-induced polymerization and copolymerization of styrene and isobutene in ethyl chloride were investigated at −78 and 0° and with a monomer concentrations of 2.5 mol/l. The polymerization rates of styrene and isobutene at −78° were 20.1×10^6 and 14.1×10^6 mol/l-sec, respectively. The copolymerization rate at −78° for all initial mixture compositions was less than the individual polymerization rate. Isobutylene did not polymerize at 0°, and there was a different relationship between the copolymerization rate and the initial mixture composition. The rates of polymerization of styrene and isobutylene were proportional to the dose energy and to the first degree of the monomer concentration. The data on the copolymer composition and the kinetic relationships showed that γ-ray-induced low temperature polymerization of isobutene and styrene was brought about by carbonium chains. (OID)

23761 POLYSTYRENE DAMAGE BY IONIZING RADIATION. E. E. Baroni. Vysokomolekulyarnye Soedineniya, 3: 960-5(1961).

A study of the effect of polystyrene irradiated with Po^{210} or $Ce^{144}-Pr^{144}$ for a period from 17 to 150 days showed that the decrease in luminescence yield of polystyrene scintillators was the direct result of radiation damage. The impairment was caused by the chemical change in the scintillator. Two different reactions occurred: (1) condensation in the bulk of the polymer caused by the radicals formed, and (2) oxidation of the surface layers of the scintillator (or polystyrene) due to the presence of air. The aldehyde and carboxyl groups were the oxidation end products at the polymer surface. (OID)

23762 COPOLYMERIZATION OF ACRYLONITRILE AND ETHYLENE UNDER THE EFFECT OF GAMMA RADIATION. V. F. Gromov, P. M. Khomikovskiĭ, and A. D. Abkin. Vysokomolekulyarnye Soedineniya, 3: 1015-19 (1961).

The Co^{60} γ-ray-induced copolymerization of ethylene and acrylonitrile (AN) in toluene at 20° was investigated. Test results showed that the rate of the process and the mean molecular weights of the polymers increased with increasing acrylonitrile content. The copolymers were enriched in acrylonitrile for all monomer ratios. The monomer reactivity ratios calculated from the copolymer compositions were $r_{1(AN)} = 7$ and $r_2 \simeq 0$. (OID)

23763 ON THE CALCULATION OF THE DIFFUSION OF RADIOACTIVE GASES. II. (NOBLE GAS DIFFUSION IN SOLIDS. 8). H. Gaus (Hahn-Meitner-Institut für Kernforschung, Berlin). Z. Naturforsch., 17a: 297-305(Apr. 1962). (In German)

Solutions were obtained for diffusion equations with given source terms in the form place function times time function and diffusion coefficients of the same form by integration and substitution of the corresponding solution of the source-free equations with coefficients constant with time. The calculations can be used for the discussion of neutrons and radioactive gases. As an example of the latter the variation with time of the resulting activity was calculated by gradual change and harmonic vibration of the source strength. The possibility of measurement by this means of the diffusion coefficient without knowledge of the activity of the test body is discussed. The behavior was calculated by change of the diffusion coefficients with time in the form of a sloped curve. The interaction of many particles are discussed. (tr-auth)

23764 CONCERNING THE BREAKING OF CHEMICAL BONDS IN BROMO- COMPLEXES OF THE NOBLE METALS AS RESULTS OF THE Br^{80} NUCLEAR ISOMERIC TRANSITIONS. W. Herr and G. B. Schmidt (Universität, Cologne; Inst. für Radiochemie, Jülich; and Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 17a: 309-14(Apr. 1962). (In German)

Isomer transitions to Br^{80g} were observed in Br^{80m}-labeled bromine complexes with Re, Os, Ir, Pt, Co, and Rh. Decomposition of the complexes was noted as a result of these isomeric transitions. (M.C.G.)

23765 THE INCREASE OF F-CENTER FORMATION BY X-IRRADIATION OF KCl CRYSTALS WITH Ca-ION DOPING. F. Froehlich (Universität Halle Saale, Ger.). Z. Naturforsch., 17a: 327-31(Apr. 1962). (In German)

It is shown that the variation with time of radioinduced F-center formation at room temperature in Ca-doped KCl crystals can be represented by an analytical expression. This agreed in form with an expression found earlier for pure crystals, and led to the assumption of a further supplementary constituent of anion vacancies, in addition to the two kinds of anion vacancies effective in pure crystals, whose concentration was determined by the Ca ion content, and to one with formation rate of new vacancies during x-irradiation increased by the Ca ion content. (tr-auth)

23766 LATTICE CONSTANT CHANGE BY COLOR CENTER FORMATION IN NEUTRON IRRADIATED LITHIUM FLUORIDE. Hans Peisl and Wilhelm Waidelich (Technische Hochschule, Munich). Z. Naturforsch., 17a: 443-5 (May 1962). (In German)

In connection with investigations of lattice disturbance in LiF by reactor irradiation, the concentration of color centers after neutron bombardment was determined. Essentially F and M centers were observed. At the same time the changes in the lattice constants of the LiF crystal was measured. The dependence of the change of lattice constants on the color center concentration and on the anion vacancies formed by neutron bombardment is shown. (M.C.G.)

23767 THE RADIOLYSIS OF LIQUID AMMONIA. L. Kolditz and U. Proesch (Friedrich-Schiller-Universität, Jena, Ger. and Deutschen Akademie der Wissenschaften, Bereich, Ger.). Z. physik. Chem. (Leipzig), 218: 108-40 (1961). (In German)

The radiolysis of liquid ammonia by γ radiation was investigated by various methods. The first detectable radiolysis products are radicals. The yields obtained were $G(H) = 0.94$ and $G(NH_2) = 1.04$. The primary molecular

yields have the values $G(H_2) = 0.37$ and $G(N_2H_4) = 0.35$. The pattern of secondary hydrazine decomposition in acid, neutral, and alkaline media was indicated. The decomposition in acid solution (presence of NH_4^+ ions) is explained by the effectiveness of solvated electrons. On the basis of individual results, a radiolysis mechanism for liquid ammonia was derived and compared with the known mechanism for the radiolysis of water. (tr-auth)

23768 ON THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS. I. CONCERNING THE BLEACHING OF OXYGEN-CONTAINING METHYLENE BLUE SOLUTIONS BY MEANS OF 50-kev X RAYS IN PRESENCE OF PHENOLS. Dietrich Schulte-Frohlinde and Nikolaus Rakintzis (Inst. for Radiochemistry Nuclear Research Center, Karlsruhe, Ger.). Z. physik. Chem. (Frankfurt), 32: 229-37(May 1962).

The rate of the bleaching of aqueous, oxygen-containing methylene blue solutions by means of 50 kev x rays was measured for its dependence on the concentration and the constitution of added phenols. At lower phenol concentrations the half-value dose for bleaching increased linearly with phenol concentration. At higher concentrations however, a saturation effect entered the protective action. It had its cause in the bleaching of methylene blue by O_2^- radicals against whose attack, materials with small reduction potentials are no more protected. In solutions free of protective materials the O_2^- radical contributes only slightly to destruction of the color material. (tr-auth)

Raw Materials and Feed Materials

Refer also to abstract 23385.

23769 (ACCO-2) POSSIBLE SUBSTITUTES FOR GLUE IN SOUTH AFRICAN ORE TREATMENT. Topical Report. R. J. Woody (American Cyanamid Co. Atomic Energy Div., Watertown, Mass.). May 14, 1951. Contract AT(49-1)-533. 14p.

The effectiveness of possible substitutes for glue as aids to filtration of acid-leached residues in South African U ore treatment was investigated. Of the reagents tried, sodium carboxy-methyl cellulose appeared most effective. Development of methods for improving filter capacity, cake formation, and washability in South African ore treatment is also reported. (J.R.D.)

23770 (ACCO-17) PROGRESS REPORT [ON PROCESSING URANIUM ORES], NOVEMBER 16, 1951–JANUARY 15, 1952. (American Cyanamid Co. Atomic Energy Div., Watertown, Mass.). Contract AT(49-1)-533. 103p.

Final tests are described on ore samples from the Belgian Congo. Leaching, precipitation, and ion exchange testing were continued on ore samples and leach liquors from Radium Hill (South Australia) Temple Mountain, Lukachukai, and Rand. Test work on U recovery from residues remaining after HF production from Utah fluorite was completed. A Climax flowsheet for U recovery was tested, and preliminary results from resin-in-pulp study on a semi-pilot plant scale are presented. Discussions are included concerning the results of tests on the recovery of MnO_2 from Rand barren solutions, carbonate leaching on Rand ores, systematic studies on elution of U from anion exchange resins, and lyometallurgical studies on pure uranyl sulfate with a variety of organo-phosphate complexing agents. (J.R.D.)

23771 (ACCO-24) RECOVERY OF URANIUM FROM HIGH GRADE AUSTRALIAN RUM JUNGLE URANIUM ORE. Topical Report. D'Arcy R. George (American Cyanamid Co. Atomic Energy Div., Watertown, Mass.). Aug. 22, 1952. Contract AT(49-1)-533. 17p.

The leaching behavior, thickening and filtering characteristics, and recovery of uranium from high grade ore from Rum Jungle, Northern Territory, Australia are described. (auth)

23772 (ACCO-37) ION EXCHANGE STUDIES ON ACID LEACH LIQUORS FROM DURANGO RESIDUES. Topical Report. Fred Pickwick, Jr. (American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.). [Jan. 25, 1954]. Contract AT(49-1)-533. 21p.

Acid leach liquor from Durango residues was treated with ion exchange resins for uranium recovery in columnwise operation. Several competitive resins were used to determine maximum recovery of uranium under varying conditions of pH, degree of reduction, dilution, and flow rate. The results obtained indicate that the liquor should be reduced to a potential of approximately minus 400 mv (Pt vs the saturated calomel electrode), the pH brought to approximately 1.5, and a retention time of five minutes or less maintained during adsorption to give efficient recovery of uranium from an undiluted liquor. (auth)

23773 (MCW-1470) PRODUCTION OF URANIUM DIOXIDE BY FLAME DENITRATION AND REDUCTION OF AQUEOUS URANYL NITRATE. W. H. Hedley, R. J. Roehrs, and W. T. Trask (Mallinckrodt Chemical Works, Uranium Div., Weldon Spring, Mo.). June 22, 1962. Contract W-14-108-eng-8. 49p.

Experimental work demonstrated that aqueous uranyl nitrate can be converted directly to uranium dioxide by direct contact with reducing gases. This process, called the flame denitration-reduction process, produces uranium dioxide having properties that indicate attractive potential use as: an intermediate oxide for the production of metal-grade uranium tetrafluoride, an intermediate in the production of feed material for the cascade operations, and a ceramic-grade uranium dioxide for the fabrication of oxide fuel elements. The versatility is made possible by a combination of properties, which, coupled with the fact that denitration and reduction are combined in one operation, indicate a potential economic advantage in processing rates and operating costs. The oxide was demonstrated as a good raw material for the electrolytic preparation of uranium metal. A pilot-plant flame denitration-reduction system was developed that will process up to 300 pounds of uranium per hour for extended periods. The principal operating problem as yet unsolved is the production of uranium dioxide with an assay in excess of 97%. (auth)

23774 (NP-11877) REFINING OF URANIUM FROM LEACH PLANT ION EXCHANGE NITRATE ELUATES BY EXTRACTION WITH DIBUTYL BUTYLPHOSPHONATE. Mines Branch Investigation Report IR 60-120. V. M. McNamara, H. W. Parsons, and R. Simard (Canada. Dept. of Mines and Technical Surveys). Nov. 30, 1960. 21p.

Continuous liquid-liquid extraction tests were done on current samples of ion exchange nitrate eluates with 25% v/v dibutyl butylphosphonate in kerosene. From eluates containing 15 to 28 g U_3O_8/l, recoveries of 99% or better were obtained in four countercurrent stages. The effects of nitrate and sulfate concentrations on extraction equilibria were determined. The extract, analyzing 75 to 95 g U_3O_8/l, was stripped effectively in four stages with 5 to 10% ammonium sulfate solutions at pH's ranging from 3.5 in the first stage to 6.0 in the last. The uranium was precipitated as ammonium diuranate by gaseous ammonia, and the barren strip was recycled to the circuit. The effect of temperature and dilution of the ammonia with nitrogen on the filtering rate of the ammonium diuranate (ADU) precipitate

and the subsequent reduction and sintering properties were investigated. The product was of nuclear grade purity and was used to produce high density (>10.5) uranium dioxide pellets. (auth)

23775 (ORNL-TM-255) A PRODUCTION CONTROL METHOD FOR DETERMINING THE PARTICLE SIZE DISTRIBUTIONS OF THORIUM OXIDE AND THORIUM OXALATE. L. C. Bate and G. W. Leddicotte (Oak Ridge National Lab., Tenn.). June 15, 1962. Contract [W-7405-Eng-26]. 23p.

A simple and rapid analysis method that can be used to estimate particle size distributions in samples of thorium oxalate and thorium oxide is described. In an analysis, samples are pipeted at predetermined time intervals from a homogeneous mixture of particles falling through a viscous medium. The parameters of Stokes' Law are considered in this method. The natural radioactivity, originating from the decay of thorium and its radioactive daughters, in each aliquot removed during sedimentation is measured by means of a gamma scintillation counter. The weight percent of a fraction containing specific sized particles removed from this mixture is determined by comparing the amount of radioactivity in the aliquot removed with the reference sample of thorium oxalate or oxide being analyzed. Particle size distributions of from 1 to 8 microns can be analyzed by this method. (auth)

23776 (AEC-tr-4939) ON THE REACTIVITY OF URANOURANIC OXIDE. I. THE THERMAL DECOMPOSITION OF URANYL NITRATE (UNH), AMMONIUM DIURANATE (ADU) AND URANIUM PEROXIDE (UPO). Rokuo Ueji. Translated from *Nippon Genshiryoku Gakkaishi*, 1: 405-11(1959). 14p.

A study was made of the thermal decomposition mechanism of uranyl nitrate (UNH), ammonium diuranate (ADU), and uranium peroxide (UPO) by a semiautomatic recording thermal balance and an x-ray diffractometer and its high-temperature apparatus. The results show that in the thermal decomposition of UNH, uranic oxide is formed in the temperature range 320 to 570°C with a nearly monoclinic system produced. Uranic oxide is formed in the range of 340 to 550°C in the decomposition of ADU, and new diffraction lines are produced. In the case of UPO, amorphous UO_3 is formed in the range 320 to 500°C. The uranouranic oxides are always orthorhombic crystals. (P.C.H.)

23777 PRODUCTION OF URANIUM DIOXIDE. Frank A. Forward and Ian Harry Warren (to Eldorado Mining and Refining Ltd.). U. S. Patent 3,042,486. July 3, 1962.

A process is given for producing reactor grade UO_2 from UO_2CO_3. The process comprises reducing an acidic aqueous slurry of UO_2CO_3 with H_2 and/or CO at a temperature above 150°C in the presence of a catalyst (Ni, Pt, Pd, Rh gauze or strips) and a small amount of a catalytic promoter (anthraquinone, anthraquinone derivatives, and ascorbic acid). (D.L.C.)

Separation Processes

Refer also to abstracts 24081, 24343, 24344, 24345, 24564, 24644, 24645, 24646, and 24647.

23778 (ACCO-44) INVESTIGATIONS OF ION EXCHANGE METHODS FOR RECOVERY OF URANIUM FROM LIQUORS PRODUCED BY ACID LEACHING OF GUNNAR ORE. Topical Report. Norman N. Schiff and George W. Lower (American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.). June 15, 1954. Contract AT(49-1)-533. 31p.

An ion exchange testing program was completed on Gunnar acid leach liquors and pulps. A standard column system and a resin-in-pulp system, both using anion exchange resins, were investigated. The Gunnar leach liquors are readily amenable to the recovery of uranium by ion exchange. (auth)

23779 (DC-61-6-5) TEMPERATURE DEPENDENCE OF FISSION PRODUCT RETENTION ON A METALLIC SURFACE. James J. Mueller (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). May 26, 1961. Contract AT(11-1)-171. 15p.

The results of an investigation of the retention of fission products on a stainless steel A-286 metal surface as a function of temperature are reported. The removal of fission products is shown to be temperature-dependent. Thermal decontamination shows promise as a method of removing most of the surface contamination from metals with high melting points. (auth)

23780 (HW-68021) SHIELDING REQUIREMENTS FOR NPR PRODUCTION IN PLUTONIUM RECLAMATION FACILITY—PROJECT CAC-880. H. A. Moulthrop (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 5, 1961. Contract AT(45-1)-1350. 13p.

An investigation was conducted concerning the variance in shielding required for relative dose rates which will exist when NPR Pu, rather than NPF Pu, is processed in the Plutonium Reclamation Facility. It was found that if NPR, rather than NPF Pu, is processed in the Plutonium Reclamation Facility an 18-in. concrete wall on the cell with NPR will give the same over-all dose rate in the working area as the 24-in. wall does for NPF. With NPR Pu being processed, retention of the 24-in. cell wall will result in approximately 0.25 mrem/hour less dose rate in the working area than would be the case if the cell wall is reduced to 18 in. Compared with a conventional process hood, the dose rate in the working area will be 5 mrem/hour less by placing the equipment in the cell. With a 6-in. thickness of plexiglas placed around the conventional process hood to reduce neutrons, the dose rate from the process hoods would be reduced to approximately 0.5 mrem/hour less than for the cell arrangement. However, the necessity for removing the neutron shield frequently to perform glove operations and the higher body exposures received at these times is estimated to result in higher personnel exposure than with the cell arrangement. (auth)

23781 (HW-SA-2458) CURRENT STATUS OF SOLVENT EXTRACTION PROCESSING OF IRRADIATED URANIUM FUELS. M. K. Harmon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Feb. 22, 1962]. Contract AT(45-1)-1350. 33p.

For presentation at Nuclear Congress, New York, June 1962.

Developments in solvent extraction plants, equipment, and processes are reviewed. Topics covered include the Redox process, natural and slightly enriched uranium, enriched uranium, nuclear criticality, the Purex Process, increased flexibility and versatility, economy and efficiency, solvent degradation and treatment, solvent-process relationship, the Thorex process, power fuels processing, equipment and instrumentation, and alternate methods of extraction. (M.C.G.)

23782 (IDO-14582) SODIUM FLUOZIRCONATE PRECIPITATION PROCESS FOR ZIRCONIUM FUELS. PART 1. LABORATORY DEVELOPMENT. B. J. Newby (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). May 15, 1962. Contract AT(10-1)-205. 31p.

Precipitation, evaporation, and extraction feed preparation conditions are established for the removal of zirconium and fluoride from fuel dissolver product solutions by the addition of sodium formate. A sparingly soluble complex fluozirconate is formed. Ninety-five to 99% of the zirconium and fluoride is separated from the uranium losses of 0.1% or less. Chemical material balances, based on experimental data, were developed for two flowsheets. In one flowsheet, sufficient nitric acid is added to the combined wash solution and filtrate produced during the precipitation step to destroy the formate ion (which inhibits uranium extraction) and to prevent post-precipitation during the evaporation of these solutions. The other flowsheet calls for addition of sufficient nitric acid to destroy the formate ion, but not enough to prevent post-precipitation during the concentration step. Post-precipitation removes additional zirconium and fluoride, but necessitates an additional solids-separation step. (auth)

23783 (IDO-14584) ELECTROLYTIC DISSOLUTION OF NUCLEAR FUELS. PART III. STAINLESS STEEL (304) IN NITRATE SOLUTIONS. J. R. Aylward and E. M. Whitener (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). June 1, 1962. Contract AT(10-1)-205. 23p.

The potential-current density relationships for 304 stainless steel dissolution in a nitrate system were studied as a function of solution composition and temperature in order to optimize the conditions for electrolytic dissolution of this material. In the nitrate system, the anodic dissolution of steel takes place in the transpassive region. Under some conditions, deviations from Tafel behavior are observed which depend greatly on the nitrate and hydrogen ion concentration, and on temperature. A discussion of passivity, transpassivity, secondary passivation, the limiting current density, and the effect of alloy composition on the dissolution behavior is given. It was found that at temperatures above 60°C efficient dissolver operation should be possible over a wide range of solution compositions and at current densities up to 2 amp/cm^2. (auth)

23784 (ORNL-2971(Vol.1)) BIBLIOGRAPHY ON NUCLEAR REACTOR FUEL REPROCESSING AND WASTE DISPOSAL. VOLUME 1. CHEMISTRY AND PHYSICS OF IMPORTANT ELEMENTS. T. F. Connolly (Oak Ridge National Lab., Tenn.). Contract [W-7405-eng-26]. 253p. 1960.

Approximately 1265 references are given to books, bibliographies, symposia, journals, and contractors' topical reports. Most of the material dates from the 1955 Geneva Conference to the present. The Section contains many references to separation methods and conditions, particularly on a laboratory scale, along with special tests or uses such as construction materials or reagents in standard processes. (P.C.H.)

23785 (ORNL-2971(Vol.3)) BIBLIOGRAPHY ON NUCLEAR REACTOR FUEL REPROCESSING AND WASTE DISPOSAL. VOLUME 3. FISSIONABLE MATERIAL-RECOVERY. T. F. Connolly (Oak Ridge National Lab., Tenn.). 1960. Contract [W-7405-eng-26]. 165p.

Approximately 800 references on head-end treatments, recovery of irradiated Th and U, and recovery of Pu are given to books, bibliographies, symposia, journals, and contractors' topical reports. Most of the material dates from the 1955 Geneva Conference to the present. (P.C.H.)

23786 (ORNL-3271) ION EXCHANGE PURIFICATION OF PROMETHIUM-147 AND ITS SEPARATION FROM AMERICIUM-241, WITH DIETHYLENETRIAMINEPENTAACETIC ACID AS THE ELUANT. P. B. Orr (Oak Ridge National Lab., Tenn.). July 6, 1962. Contract W-7405-eng-26. 11p.

Based on a half life of 2.64 ± 0.02 years, a calculated weight of 2.032 g of $Pm_2^{147}O_3$ in 9 g of fission-produced rare-earth and americium oxides was separated in two runs by cation exchange (Dowex 50W-X4 resin, 80 mesh), with diethylenetriaminepentaacetic acid solution as the eluant. Promethium, computed as the element, was present to the extent of about 23.5 wt % in the starting mixture and was increased to 98 wt % in the first run and to 99 wt % in the second, with yields of 58.2 and 61.8 wt % respectively. A decontamination factor of 2.7×10^9 was realized in the removal of americium from the product. Procedures, a modified elution curve, methods of analysis, losses, material balances, and a description of the equipment are given. In addition, a possible colorimetric analysis scheme (qualitative) is given for determining the proportions of neodymium and promethium in a solution. (auth)

23787 (ORNL-3285) EXTRACTION OF NIOBIUM-95 FROM NITRIC ACID SOLUTIONS WITH TRI-n-BUTYL PHOSPHATE. J. G. Moore and R. H. Rainey (Oal Ridge National Lab., Tenn.). July 9, 1962. Contract W-7405-Eng-26. 21p.

The distribution coefficient (DC o/a) of Nb^{95} between aqueous nitric acid and 30% Tri-n-butyl phosphate (TBP) in n-dodecane increased from ~0.004 to 0.1 N acid deficient solution to 0.05 in 4 M HNO_3 for the extractable portion of the niobium. Greater than 70% of the niobium was unextractable. The presence of 3% chemically degraded TBP, 7% chemically degraded Amsco, or both decreased the amount of unextractable niobium to < 20% and degraded TBP increased the distribution of the extractable portion. The aqueous solubility of the niobium extractant in the degraded reagents varied inversely with the acidity of the aqueous phase. The maximum DC o/a from acid deficient solutions containing solvent degradation products was ~0.008. The organic to aqueous DC o/a were higher than the aqueous to organic values for all solutions examined. Niobium retention was maximum by solvents containing both degraded TBP and Amsco, increasing from 6% to ~50% as the aqueous acidity decreases from 5 to 0.1 M HNO_3. Nb^{95} was removed from nitric acid solutions containing 20 g/liter Zr and Zr^{95} by adsorption on unfired Vycor glass. (auth)

23788 (ORNL-TM-184) SOLVENT EXTRACTION SEPARATION OF NEODYMIUM AND PROMETHIUM USING DI(2-ETHYL-HEXYL)ORTHOPHOSPHORIC ACID AS EXTRACTANT. Baldomero Lopez Perez and R. E. McHenry (Oak Ridge National Lab., Tenn.). July 6, 1962. Contract [W-7405-Eng-26]. 12p.

A multistage continuous solvent extraction process using di(2-ethyl-hexyl)orthophosphoric acid (D2EHPA) as an extractant was developed for the fractionation of the rare earths. The process was developed particularly for the separation of fission neodymium and promethium. To obtain a significant production rate with D2EHPA requires that the variation in the distribution coefficient of the solute from stage to stage (due to loading effect and pH changes) be controlled within operable limits. This can be done by using a high concentration organic phase (1 molar) and high acid aqueous phase (0.74 molar). With organic phase loading to 24% the variation in K_d does not exceed a factor of 2. Separation factors using toluene diluent and nitric acid aqueous phase were about 1.7, but the K_d's were too low for a high production rate at reasonable organic flow. With Amsco as a diluent, the separation factors were still ~1.7, but the K_d's were much higher. In the pilot-plant scale demonstration, good process stability and near theoretical separation were obtained in an 11-stage mixer-settler. (auth)

23789 (ORNL-TM-241) THORIUM UTILIZATION PROGRAM: A SURVEY OF PROCESSING METHODS FOR THORIUM REACTOR FUELS. W. L. Carter (Oak Ridge National Lab., Tenn.). July 12, 1962. Contract W-7405-Eng-26. 57p.

The field of chemical processing of Th reactor fuels was surveyed and is discussed. Th processing can be categorized as aqueous, fused fluoride salt or pyrometallurgical; the several processes in each of these classifications are discussed from the standpoint of process description, performance, materials of construction, limitations, and advantages, cost data, and status of development. (auth)

23790 (ORNL-TM-244) WATER REQUIREMENTS FOR A RADIOCHEMICAL PROCESSING PLANT. F. E. Harrington (Oak Ridge National Lab., Tenn.). May 28, 1962. Contract [W-7405-eng-26]. 17p.

A survey of the water requirements is presented for a hypothetical plant to process all the fuel from a 15,000-Mwe nuclear economy. For each processing plant, specific requirements must be based on a detailed water survey which includes water quality, process requirements, and in-plant conservation plans. These considerations are discussed and the quantitative requirements are listed. (J.R.D.)

23791 (TID-16139) THE SOLVENT EXTRACTION OF NITROSYLRUTHENIUM BY TRILAURYLAMINE IN NITRATE SYSTEM. Summary Report for the Period, July 1, 1960 to March 31, 1962. Richard E. Skavdahl and Edward A. Mason (Massachusetts Inst. of Tech., Cambridge). June 1, 1962. For Oak Ridge National Lab., Tenn. Contract W-7405-eng-26, Subcontract 1327. 251p. (MITNE-20)

An investigation of the solvent extraction characteristics of the nitro and nitrato complexes of nitrosylruthenium in nitric acid–sodium nitrate aqueous media was conducted. As the organic extractant phase, a solution of trilaurylamine (TLA) in toluene was utilized. In addition to the usual process parameter variation type of experiment, a rapid dilution type of experiment was used extensively to determine qualitative and semiquantitative results regarding the degree of extractability and concentration of the more extractable species of the nitrato complexes of nitrosylruthenium. It was found that the acids of the tetra-nitrato and penta-nitrato complexes were the more extractable species for that set of complexes and that the acid of the penta-nitrato complex was the more extractable of the two. It was observed that for freshly prepared solutions, the dinitro complex of nitrosylruthenium was much more extractable than the gross nitrato complexes solutions. Nitro complexes in general, and the dinitro complex in particular, may be the controlling agent in ruthenium decontamination of spent nuclear fuel processed by solvent extraction methods. The experimental results from both sets of complexes could be more meaningfully correlated on the basis of unbound nitric acid concentration in the organic phase than on the basis of nitric acid concentration in the aqueous phase. The extraction of nitric acid by TLA from nitric acid-sodium nitrate aqueous solutions was investigated and the results correlated on the basis of activity of the undissociated nitric acid in the aqueous phase. (auth)

23792 (AEC-tr-5099) THE SEPARATION OF ZIRCONIUM AND HAFNIUM IN SULPHURIC SOLUTIONS USING ANION EXCHANGERS. Bernard Trémillon, C. Cornet, M. Thibault, and J. Huré (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Translated from report CEA-1944. 1961. 26p.

Also published in Bull. soc. chim. France, p.286-94(1961).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 15672.

23793 APPARATUS FOR THE EXTRACTION OF URANIUM AND RARE METALS FROM AQUEOUS SOLUTIONS. B. N. Laskorin, I. A. Yakubovich, G. P. Zuev, V. G. Krasov, V. F. Smirnov, and V. E. Pivovarov. Atomnaya Energ., 12: 503-13(June 1962). (In Russian)

Extraction processes were used with great success during the last decade for the separation of elements such as Au, Al, Ga, Ni, and Co and also in the nuclear industry including the reprocessing of spent nuclear fuels. The mixer-settler type installation presents special advantages; their operational principles and constructional details are described. The separation of liquids after mixing is receiving special effort lately. Mixing is carried out by means of mechanical or air mixers. The efficiency of settlers is improved by the incorporation of plates which increase the surface area without a corresponding increase in the dimensions of the apparatus. Use of centrifugal rotors, addition of surface-active materials and employment of ultrasonic separators appear to represent the most hopeful methods. (TTT)

23794 SEPARATION OF PLUTONIUM AND URANIUM BY SOLVENT EXTRACTION. Marc Lefort (Laboratoire Joliot-Curie, Faculté des Sciences, Orsay, France). Bull. Soc. chem. France, 3: 616-17(Mar. 1962). (In French)

A method is described which permits rapid yields higher than 80% of Pu traces from a large quantity of U. The extraction of Pu takes place in a mixture of tributyl phosphate and 1,1,1-trifluoro-3,2-thenoyl acetone. (tr-auth)

23795 RESEARCH CONCERNING THE CHEMICAL PROCESSING OF URANIUM IN HUNGARY. Miklós Fodor, Péter Foeldes, Fernec Molnár, Lajos Stocker, Elek Szabó, and Mihály Vigvári. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 303-25(July-Aug. 1958). (In Hungarian)

Methods applied in the carbonate leach and acid recovery of Hungarian uranium ores, as well as the influence of various parameters on the recovery efficiency are described; results concerning the role and efficiency of applying ion exchange resins in the process of carbonate leaching are given. The adsorption of uranyl sulfate and uranyl tricarbonate complexes in recovery and synthetic sulfuric acid and alkaline uranium solutions on various ion exchange resins is investigated. These experiments are carried out on a fixed resin bed, by fluid and resin-in-pulp methods. The capacity of Hungarian ion exchange resins is analyzed as a function of sulfuric acid and carbonate leach concentration, uranium content, temperature, and resin grain size, as well as the stability of these resins in the case of synthetic, filtered, and pulp recovery solutions. (auth)

23796 SOME INVESTIGATIONS OF THE EXTRACTION OF URANIUM COMPOUNDS. Lech Stolarczyk. Nukleonika, 7: 39-42(1962). (In Polish)

The discussion primarily deals with the selective extraction of uranium salts from the point of view of the interaction of uranium ions with the substances used in extraction. The mechanism of extraction is investigated. Uranium solutions are investigated spectrophotometrically in a study of the extraction of U(IV) and U(VI) compounds. (TTT)

23797 INFRARED SPECTROSCOPIC STUDY OF THE MECHANISM OF THE EXTRACTION URANYL NITRATE WITH TBP. Kenkichi Nukada and Utako Kambayashi. Rpts. Govt. Chem. Ind. Research Inst., Tokyo, 57: 171-8 (Apr. 1962). (In Japanese)

The complex formation of TBP in the systems TBP–H_2O, TBP–HNO_3, and TBP–$UO_2(NO_3)$ was confirmed by means of infrared spectroscopy. The infrared spectra of uranyl nitrate in the system TBP–HNO_3–$UO_2(NO_3)_2$ lead to the conclusion that the competitive extraction of both uranyl nitrate and nitric acid takes place during the extraction process. (auth)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

23798 (AD-269390) MAIN PROPULSION "STEAMOTOR." APPENDIX 3. R. J. Hooker (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Oct. 1961. Contract NONR 3485(00). 51p.

A study made of the problems of integrating the steam engine into a submarine is presented. A high-performance steam engine design is proposed with modifications that can be done to the design to alleviate most of the objections. This study used the aircraft engineers' approach of using the radial engine configuration, with a master and link rod connecting rod. In addition, the philosophy of water-lubricated bearings is utilized as the basis of the several designs that are believed to have the most merit. The possibility is shown of consolidating the engine, condenser, boiler feed pump and lubricating water pump into one package. Included in this study were barrel engines, incorporating several designs of the slider or cam drives; and, while they look attractive, it was felt that the technical problems were too overpowering to continue giving them much consideration. (auth)

23799 (AD-269398) LOW MAINTENANCE MACHINERY FOR SUBMARINE POWER PLANTS. APPENDIX 11. EVALUATION OF SUBMARINE POWER TRANSMISSION. H. Stern (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Oct. 1961. Contract NONR 3485 (00). 14p.

The evaluation of transmission systems for steam-powered submarines is summarized. Following a more detailed investigation of certain types of fluid transmissions, all information available on mechanical, fluid, and electrical transmissions was collected. The merits of each of 31 transmissions and comparison with the systems design goals reduced the field to 4 transmissions. It was concluded that the direct coupled steam turbine is the only presently feasible transmission system which meets the reliability, maintenance, and noise requirements prescribed in this program. The steam motor direct drive is superior to the steam turbine because of its considerable weight advantage. Third place in the lineup of feasible transmissions can go to either hydraulic or electric transmissions dependent mainly on the weight vs efficiency criteria imposed on the system. (auth)

23800 (AD-269399) LOW MAINTENANCE MACHINERY FOR SUBMARINE POWER PLANTS. APPENDIX 12. PROGRESS REPORT ON FLUID TRANSMISSIONS. H. Stern (General Electric Co. General Engineering Lab., Schenectady, N. Y.). July 1961. 20p.

A survey of various propulsion schemes is presented. The investigation includes evaluation of a hydrostatic motor drive for a submarine propeller in which values for size, efficiency, and possible configuration were obtained. Other items examined include oil hydraulic motors, and sea water hydraulic motor drives. Specification and performance data are included. (J.R.D.)

23801 (DC-60-1-37) D-103 BY-PASS VALVE BEARING DEVELOPMENT. Final Report. R. K. Fagley (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Jan. 5, 1960. Contract AT(11-1)-171. 53p. (TMDR-609)

A summary is presented of development on the D-103 by-pass valve bearings. Ninety degree oscillation tests at 750 and 900°F were performed at slow speed under 1500-lb load on the bearings. Results indicate that at 900°, an uncoated full complement bearing performed best while at 750° a bearing with a cage coated with Surf-Kote M-1284 performed best. (J.R.D.)

23802 (NP-11683) HIGH-TEMPERATURE LUBRICATION PROBLEMS. M. J. Hughes (Gt. Brit. National Engineering Lab., East Kilbride, Glasgow, Scotland). Apr. 1960. 22p. (NEL-LDR-15/60)

High temperature lubrication problems have arisen due to advances in the aircraft and nuclear power industries and in the material forming industries supplying them. The extent to which these exist is surveyed and the research work undertaken to solve them is discussed. A number of solutions are now being investigated, these include solid surface lubricants and solids acting as fluids at high temperatures. One suggestion is the use of chemically active gases to form surface films having low shear strength. Fundamental research is being carried out on high temperature lubrication that should form the basis of research to provide design data. (auth)

23803 (R60GL185) THE ROLE OF SURFACE FILMS IN LUBRICATION. R. T. Foley and M. B. Peterson (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Sept. 28, 1960. Contract AT(11-1)-171. 40p.

An investigation is described in which the role of surface films in lubrication was examined. The approach used was primarily through chemistry and involved interpretation of carefully performed friction tests in various atmospheres in terms of predicted surface reactions. The experiments were concerned with Co sliding on Co, Fe on Fe, and Ni on Ni. The experiments pointed out some new problems that need answering but results demonstrated the significance of adsorbed films. Discussions of experimental techniques and resulting data are included. (J.R.D.)

23804 (RM-3105-AEC) ELASTIC WAVE CALCULATIONS FOR THE COWBOY PROGRAM. Blaine R. Parkin (RAND Corp., Santa Monica, Calif.). June 1962. Contract AT(04-3)-414. 38p.

Theoretical calculations for elastic wave radiation from spherical cavities in salt were compared with close-in experimental results from the Cowboy Program of underground high explosive tests. The over-all agreement between experiment and theory is thought to be excellent. More detailed comparisons showed that the salt does depart from elastic behavior as a result of plasticity at distances close to the cavity for large charge weights and as the result of other losses at small strains which enhance attenuation of the waves at larger distances. The theoretical findings are used to suggest new ways for correlating such quantities as explosive and radiated energies, peak values of particle displacement, velocity, acceleration, and radial stress. The potential usefulness of these procedures was tested by using them to find a new way of scaling experimental values of the peak particle velocities from all uncoupled shots of the Cowboy tests. (auth)

23805 (TID-15212) ON THE TIME DEPENDENT EFFECTS OF SELF-ACTING GAS DYNAMIC JOURNAL BEARINGS. C. H. T. Pan (Mechanical Technology Inc., Latham, N. Y.). Feb. 15, 1962. Contract Nonr-3730(00). 34p. (MTI-62TR1).

Time dependence of the isothermal Reynolds equation

can be identified to consist of one part which depends on the initial condition of the fluid film and another part which is related to the motion of the journal. The latter is proposed to be named "intrinsic time dependence." The partial differential equation for the "intrinsically" time dependent problem is of the elliptical type. A perturbation method to solve this equation, based on the assumption of small time dependent effects, is developed. Beginning with the steady state solution, the governing equations for various time dependent orders are developed in succession. The recurrence relation for these equations is established. For the case of a nearly concentric journal undergoing a small translatory motion, closed form solutions are obtained for "intrinsic" time dependent effects up to the second order. This analysis permits the computation of "intrinsically" time dependent fluid film forces once and for all, which can then be used for the stability analysis of all steady state rotor motions. (auth)

23806 (TID-15295) ON THE HYBRID GAS LUBRICATED JOURNAL BEARING. J. W. Lund (Mechanical Technology Inc., Latham, N. Y.). Mar. 15, 1962. Contract Nsar-3730(00). 64p. (MTI-62TR2)

The load carrying capacity of an external pressurized gas journal bearing was analyzed including the hydrodynamic effect caused by the rotational speed of the journal. The analysis is an approximate first order perturbation solution, i.e., it assumes small bearing eccentricity ratio. Furthermore, it is assumed that the gas feeding takes place through orifices in the centerplane of the bearing and that the number of feeding holes is sufficiently large to be considered a line source. Results are given for the load carrying capacity and for the attitude angle. In addition an investigation was made of the validity of the approximation used in arriving at the solution. (auth)

23807 (TID-15979) CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 62. A. G. Pickett and C. L. Whitney (Southwest Research Inst., San Antonio). May 15, 1962. Contract AT(30-1)-2140. 6p.

The vessels under study have a 36 in. ID and a 2 in. wall thickness. Discussions are included concerning cycling pressures for use on vessel #5 along with a review of the stress-strain curves of the vessel materials, and other discussions on inspection and crack repair. (J.R.D.)

23808 (FTD-TT-62-530) REMOTE HANDLING DEVICE FOR THE MANIPULATION OF ISOTOPES OF DOMESTIC MANUFACTURE. Jozsef Hirling. Translated from Energia es Atomtech., 13: 379-81(Aug. 1960). 5p.

A remote handling device is described which may be used to handle isotopes from behind a protective shield. The manipulator bridge consists of the external differential with a handle, two guide heads and an internal differential with exchangeable tong jaws. The generated motion is in each case transmitted to the active side by means of wire ropes. Other details are given. (J.R.D.)

23809 RADIOISOTOPE LABORATORIES FOR HIGH AND MEDIUM ACTIVITIES IN CZECHOSLOVAKIA. Radoslav Hejlek and Joseph Kortus. Czech. Heavy Ind., No. 11, 16-20(1961).

In connection with the establishment of nuclear power plants, the Czech Government is exploring expanded production and wider use of radioisotopes in industry, science, medicine, and agriculture. For this purpose, the recently established Inst. for Nuclear Res. of the Czechoslovakian Acad. of Science is devoted to basic and applied research in radioisotope physics and chemistry. In factories and research institutions, special radioisotope laboratories have been set up and, while the use of radioisotopes is gradually penetrating all branches of the national economy, new plants have been built for treating, storing, and using nuclear waste products. "Hot laboratories" are built on a multizonal plan of separation of spaces according to the degree of activity to be handled. A typical example of a major "hot plant" is the Radiochemistry Lab. of the Inst. for Nuclear Research. Here "hot cells" are established in which manipulators carry out operations by remote control. Heavy Pb shielding and shielding blocks of concrete or cast iron can be assembled to suit operational requirements. Very active radioisotopes are stored underground in large cast-iron drum or sealed sheet-metal boxes. Drum magazine can store up to 276 receptacles with a total activity from 5 to 500 c. Semi-hot labs., which are attached to these "hot labs.," give sufficient protection and allow easier treatment of substances of lesser radioactivity. The problem of radioactive waste disposal in Czechoslovakia is discussed. (OID)

23810 PRACTICAL APPLICATIONS OF γ-RAY LEVEL GAGES. Tetsuo Sumi. Hitachi Hyôron, 42: 1333-8(Dec. 1960).

The principles of 7 different types of γ-ray level gages are described briefly, and their advantages, disadvantages, and various uses are discussed. The proper selection and precautionary measures for installation and operation of level gages are discussed. (OID)

23811 THE HOOD, ESPECIALLY FOR WORK WITH RADIOISOTOPES. A. R. P. Janse and D. De Zeeuw. Kernenerg. in Landbouw, 1: 9-11(Jan. 15, 1960).

The rapid expansion of work with radioactive preparations has created special problems in laboratory equipment, e.g., the construction of a proper hood. In the chemical laboratory the hood serves for the removal of noxious fumes and proper ventilation, whereas in the radiation laboratory the hood must meet the even more rigorous requirement of radiation protection. This requirement determines its form and size, construction and outfitting. The various materials used for hood construction and the standard models used in the Netherlands are described. Dutch firms which manufacture hoods for radiation work and the specific types of hoods in which these films specialize are given. (OID)

23812 DETERMINATION OF CURRENT EFFICIENCY IN ALUMINIUM FURNACES. László Bozóky and Dániel Voedroes. Magyar Tudományos Akad. Központi Fiz Kutató Intézetének Közleményei, 6: 285-90(July-Aug. 1958). (In Hungarian)

A method is developed for measuring the current efficiency of Al furnaces, which by its rapid execution renders possible the application of short-half-life isotopes, and therefore does not cause any important radioactive contamination. The essence of the method is direct measurement of samples taken of the material to be fed in the furnace and of samples taken after dilution, so that the quantity of the melt might be determined accurately and rapidly, using the smallest possible amount of hot laboratory work. Diffusion of isotopes in melt is examined by laboratory tests. Autoradiography and direct measurement results prove that complete homogenization may be obtained by diffusion alone. Times necessary for homogenization are also determined. After testing various processes, the apparently most suitable method of preparing and feeding master alloys in the furnace was determined. In order to ensure that the dimensions of the master alloy samples are identical with those taken from the furnace, a

special ingot mould is designed, which permits the manufacture of a considerable number of identical samples within a short time. A measuring stand is constructed, by which great specific activities of master alloys to be fed in the furnace, as well as specific activities smaller by several orders of magnitude of samples taken from the furnace, can be promptly and directly measured with the required accuracy. By this arrangement, at measurements of great activities absorbent lead shields are inserted between the sample to be measured and the G-M counting tube. Thus it is ensured that direct radiation and scattered environment radiation are always reduced identically. Consequently the transfer coefficient becomes a fixed value that may be determined. Eventual further diffusion of isotopes from the molten metal is measured. The accuracy of the method is verified by direct weighing of the aluminum drawn off by tapping. (auth)

23813 GAS FILM LUBRICATION. W. A. Gross. New York, John Wiley and Sons, Inc., 1962. 424p. $14.00.

The fundamentals of gas and incompressible lubricating films are reviewed and their applications to important bearing configurations discussed. The characteristics of both self-acting and externally pressurized films are derived. Slider, journal, thrust, and spherical bearing films are analyzed for a variety of surfaces. (D.L.C.)

23814 METHOD AND APPARATUS FOR THE INVESTIGATION OF NEUTRON PROPAGATING MEDIA. Julien Martelly (to Commissariat à l'Énergie Atomique). U. S. Patent 3,042,803. July 3, 1962.

A method is outlined for determining rapidly and precisely the neutron characteristics of media, especially the Laplacian operator and diffusion length. The method comprises creating a predetermined neutron flux through a closed surface area surrounding a sample of the medium, establishing boundary conditions for the flux through a second closed surface within the first surface, defining an accurate boundary for a portion of the medium, and measuring the flux within the portion. Apparatus for carrying out the method is described. (D.L.C.)

23815 METHOD AND APPARATUS FOR EFFECTING GAS-STABILIZED ELECTRIC ARC REACTIONS. Harry K. Orbach (to MHD Research, Inc.). U. S. Patent 3,042,830. July 3, 1962.

A gas ionizing apparatus is designed to produce a high-velocity gaseous discharge without excessive loss of power or heating for extended periods of time. In the apparatus, a portion of the gases to be heated by the arc is used as an electrode coolant. The use of the apparatus in chemical synthesis is discussed. (D.L.C.)

Heat Transfer and Fluid Flow

Refer also to abstracts 24456, 24459, 24500, 24502, 24504, 24506, 24507, 24508, 24510, and 24651.

23816 (EURAEC-42) RESULTS OF WET STEAM COOLING EXPERIMENTS: PRESSURE DROP, HEAT TRANSFER, AND BURNOUT MEASUREMENTS WITH ROUND TUBES (1960). Special Report No. 2 (CAN-1). L. Berkowitz, S. Bertoletti, J. Lesage, G. Peterlongo, G. Soldaini, and R. Zavattarelli (Centro Informazioni Studi Esperienze, Milan). Oct. 1960. Work Performed under United States–Euratom Joint Research and Development Program. Contract 002-59-11RDI. 248p. (R-27)

Data obtained with the Piacenza heat transfer facility are presented. The facility and experimental procedure are described. The computer Olivetti Elea 9002 was used for calculation of quantities of interest starting from experimental data. The range of the experiments included geometry, absolute pressure, specific mass flow rate, and quality. Burnout, pressure oscillations, and uncertainties due to singular sources of errors are discussed. Data are presented in tables and graphs. (M.C.G.)

23817 (HW-71684) A COLLECTION OF BOILING HEAT TRANSFER AND BURNOUT CORRELATIONS. C. W. Woodson and J. M. Batch (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 14, 1961. Contract AT(45-1)-1350. 37p.

Boiling correlations collected from several publications are presented using common nomenclature. The correlations are classified according to an included list of cases. These cases depend on the mode of flow, the coolant condition, and the type of boiling. Definitions and a list of standard symbols are included. (J.R.D.)

23818 (JPL-TR-32-290) EXPERIMENTAL STUDY OF A COMPRESSIBLE VISCOUS VORTEX. James M. Kendall, Jr. (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). June 5, 1962. Contract NAS 7-100. 22p.

Experiments have shown that the tangential velocity distribution of a vortex flow confined within a chamber is much different than that predicted by two-dimensional laminar flow theory. Some of the reasons for this anomaly are studied. The experiments consist of visualization studies, boundary layer velocity measurements, and hot-wire anemometer measurements of flow fluctuations and of the turbulent shearing stress. The experiments reveal a three-dimensional flow, and indicate that fluid turbulence is strongly dependent on the manner in which angular velocity is imparted to the flow. (auth)

23819 (KAPL-M-WAG-1) PRESSURE DROP REVIEW FOR NCR APPLICATION. Status Report. William A. Golub (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 1, 1959. Contract [W-31-109-Eng-52]. 25p.

Work done to establish a reference set of velocity head loss coefficients in the range of NCR flow and pipe roughness is described. Results are presented in graphs. (M.C.G.)

23820 (NAA-SR-6891) EFFECTS OF DISSOLVED NITROGEN ON SUBCOOLED NUCLEATE BOILING IN SANTOWAX R. P. R. Benson (Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif.). Dec. 20, 1961. Contract [AT(11-1)-Gen-8]. 22p.

Ten heat transfer tests were made using Santowax R coolant samples, eight being continued to the burnout point. Tests were made at pressures of 90 and 150 psia and bulk coolant temperatures ranging between 500 and 650°F. Tests were made with both vertical and horizontal heaters. Results showed that: the onset of nucleate boiling was affected to a large extent by the concentration of dissolved nitrogen, being reduced by as much as 195°F when saturated with nitrogen at 90 psia pressure, the critical heat flux was the same for coolants containing low or high dissolved nitrogen content, with evidence that the coolant was partially degassed when it contacted the heater even though there was no observed change in bulk gas concentration, and pool boiling may be a useful method for checking saturation temperature vs. pressure data obtained by other methods and for establishing approximate equilibrium relationships for systems not examined by P-V-T methods. (auth)

23821 (NAA-SR-Memo-7182) ANALYSIS OF VARIABLE GAS BOND FOR CONTROL OF HEAT FLOW ACROSS AN ANNULUS. R. C. Noyes (Atomics International, Div.

of North American Aviation, Inc., Canoga Park, Calif.). Mar. 5, 1962. Contract [AT(11-1)-Gen-8]. 9p.

An apparatus is described which employs a variable flow-rate gas (argon) bond to transfer heat across an artificially roughened 0.075-inch annular gap. A heat transfer and hydraulic analysis was made to determine the flow and pressure drop required to transfer a heat flux of 10^5 Btu/hr ft^2 at a temperature difference of 600°F. This heat transfer scheme is suggested as having possible application to control rod cooling and temperature control in fuel irradiation experiments. (auth)

23822 (NP-11818) MASS AND HEAT TRANSFER RATES FOR LARGE GRADIENTS OF CONCENTRATION AND TEMPERATURE. Technical Report No. 1. William E. Ranz (Minnesota. Univ., Minneapolis). Mar. 15, 1962. Contract DA-11-022-ORD-3084. 63p.

Procedures were developed for calculating interfacial rates of mass and heat transfer where both are being transferred simultaneously, where gradients of concentration and temperature are large, and where the mole fraction of transferred component is of an order larger than one-tenth. A description of the mathematical problem is presented. Transport properties of multicomponent gas mixtures are described. Simultaneous heat and mass transfer in a gas flow near a stagnation point is discussed. (M.C.G.)

23823 (NP-11831) FORCED-CONVECTION SURFACE-BOILING HEAT TRANSFER AND BURNOUT IN TUBES OF SMALL DIAMETER. Technical Report No. 8767-21. Arthur E. Bergles and Warren M. Rohsenow (Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering). May 25, 1962. Contract AF19(604)-7344. 149p.

A basic heat-transfer apparatus was designed and constructed for the study of forced-convection boiling in small channels. The various regions of forced-convection surface boiling were studied experimentally and analytically. In the region of low wall superheat, the heat flux can be predicted by available correlations for forced convection. Data indicate, however, that these correlations do not properly account for the radial variation of properties for water at high temperature difference. The conventional Dittus and Boelter-McAdams relationship is recommended for design purposes on the basis of its simplicity and conservative predictions. An analysis for the prediction of the inception of first significant boiling was developed. Experimental results are in good agreement with analytical predictions. The analysis provides information necessary for the prediction of the complete forced-convection surface-boiling curve. Data for a small-diameter tube indicate that the bubbles formed at incipient boiling can trip the laminar or transition boundary layer to a fully-developed turbulent boundary layer. The region of vigorous boiling coincides approximately with the extrapolation of the pool-boiling curve in one set of experiments. In other experiments, pool-boiling data were strongly influenced by fluid and surface conditions, as well as by bubble-induced convection in the pool. Due to the complexities in these pool-boiling data, it is impossible to make a conclusive comparison with forced-convection-boiling data. The heat flux obtained by a superposition of pool boiling and forced convection is close to the apparent asymptote for fully-developed boiling. For design purposes, it is concluded that fully-developed forced-convection boiling can be related to pool boiling by either direct extrapolation or superposition of forced convection. The burnout heat flux under conditions of forced convection and surface boiling is shown to be a complicated function of subcooling at low values of subcooling. This appears to be due to the velocity increase caused by the relatively large volume fraction of vapor. Burnout flux is shown to increase with decreasing tube diameter. This effect can be attributed to an increase in void fraction with decreasing tube diameter. Entrance effects are significant in forced-convection surface boiling as shown by the decrease of burnout flux with increasing length. Flow oscillations caused by system compressibility can greatly reduce the burnout heat flux in the subcooled region. This instability is particularly difficult to avoid with tubes of very small diameter. (auth)

23824 HEAT TRANSFER BY FREE CONVECTION TO FLUIDS CONTAINED IN VERTICAL TUBES. Charles Vernon Foster (Univ. of Delaware, Newark). Dissertation Abstr., 22: 3564(Apr. 1962).

Heat transfer by free convection to water and two oils contained in vertical tubes was studied. Temperature profiles at several levels across a diameter of the tube were determined. The object of this study was the determination of the factors affecting heat transfer by free convection to liquids contained in heated vertical tubes, closed at the bottom and opening at the top into a large chamber that contained a cooling coil. Experiments were conducted with brass tubes, one foot in length, with inside diameters of 0.5, 0.75, 1, and 3 inches. Heat fluxes varied from 230 to 13,300 Btu/hr-ft^2. The average temperature drop across the liquid film varied from 9.1 to 171.3°F. The results were correlated for the three smaller tubes with an equation involving two dimensionless heat-transfer groups: the Grashof number and the Prandtl number. The results for the 3-inch diameter tube followed the theoretical equation derived by Eckert and Jackson for a flat plate. Temperature profiles for turbulent flow conditions were similar to those found in fixed bed reactors. Turbulent flow conditions were noted in the three smaller tubes at high values of the product of the Grashof and Prandtl numbers. The temperature drop between the inside wall and the fluid at the centerline of the tube decreased from the top to the bottom of the tube. A temperature difference, averaged over the height of the tube, was correlated with the product of the Grashof and Prandtl numbers. This gave a correct value of the average temperature difference for design purposes.

23825 FLUID FLOW PHENOMENA IN NATURAL CIRCULATION VERTICAL TUBE BOILERS. Girard Edward Golden (Univ. of Delaware, Newark). Dissertation Abstr., 22: 3564(Apr. 1962).

Research was initiated in order to gain a knowledge of the phenomena associated with the flow of boiling fluids in tubes. Two 6-ft heat transfer tubes, 0.75 in. ID and 1.00 in. ID, respectively, were fabricated from brass. The fluids in the tubes, methanol, cyclohexane, benzene, n-pentane, and n-heptane, were vaporized by heat transfer oil which passed through an annular space formed by the tube and a 2.5 in. ID brass pipe. Friction factors were calculated assuming homogeneous flow and plotted vs the average gas phase Reynolds number. With the aid of a dimensionless group, it was possible to correlate all the friction factor data obtained. A flow pattern is proposed for vertical tube boilers operating between 0 to 100% quality. At the low range of qualities, the flow type is homogeneous while at high ranges it is annular. Between these extremes is a transitional region which is difficult to characterize.

23826 PRESSURE DROP AND HEAT TRANSFER DURING FLOW ACROSS UNBAFFLED TUBE BANKS. Harold Legrande Hull (Univ. of Delaware, Newark). Dissertation Abstr., 22: 3565(Apr. 1962).

As a part of a comprehensive research program for the study of pressure drop and heat transfer on the shell side

of tubular heat exchangers, tests were conducted on seven "ideal" heat exchanger models. These models were designed to represent the center of one baffle section of a shell and tube heat exchanger. Each model consists of a rectangular tube bundle with the tubes in the outer row of each side half-imbedded in the shell. The shell side fluid was passed once across the tube bundle. The effects of leakage, cylindrical shells, and flow in directions other than normal to the tubes are minimized in these tests of "ideal" heat exchanger models. The apparatus variables include equilateral triangle, inline square, and staggered square tube arrangements; tube sizes of $\frac{3}{8}$ inch and $\frac{3}{4}$ inch outside diameter; and pitch ratios of 1.25 and 1.50. Pressure drop and heat transfer data are reported for heating and cooling an SAE 30 oil flowing at temperature levels of 125, 150, and 175°F and at velocities of 0.04 to 6.0 feet per second through the minimum cross section. Most of the data are in the region of viscous flow, but some are in the transition and early turbulent flow regions. Existing methods of correlation are shown to be inadequate both for isothermal pressure drop and for pressure drop during heating and cooling. The data for both pressure drop and heat transfer are represented graphically using generalized coordinates. An equation is proposed to represent the pressure drop for Reynolds numbers below 50. In a comparison of the heat transfer coefficient versus the power loss per unit surface area, small, closely spaced tubes in staggered arrangements are shown to give the best performance.

23827 LOCAL AND OVER-ALL HEAT TRANSFER COEFFICIENTS IN BAFFLED HEAT EXCHANGERS. Krishnaswami Narayanan (Oregon State Univ., Corvallis). Dissertation Abstr., 22: 3566(Apr. 1962).

Local shell-side heat transfer coefficients and pressure drop were measured on a model exchanger with three different baffles. The Nusselt number, which is proportional to the heat transfer coefficient, ranged from 20 to 160. Movable sensing probe units were used to measure the local values of the coefficient and the pressure drop. Three electrically heated ribbons were wrapped around a plastic rod to act as the heating surface. Thermistors were placed under the central ribbon to measure the surface temperature of the ribbon. The heated ribbon was cooled by convection by the air flowing past the probe. The model heat exchanger contained $\frac{3}{4}$-inch aluminum tubes placed in a triangular pitch of $1\frac{1}{16}$ inches. Investigations were made with baffle spacings of 4 inches and 9 inches at constant flow rate. Four baffle openings were studied for type I baffles (orifice type, 18 tubes, unsymmetrical) and one each for baffles II (orifice type, 19 tubes, symmetrical arrangement) and III (segmental type, 18 tubes, unsymmetrical arrangement). The average heat transfer coefficient over the tube bundle in a region between two central baffles were correlated with the empirical equations $\left(\frac{h_s d_1}{k}\right)_{av}\left(\frac{C_p\mu}{k}\right)^{-1/3} = 0.0543\left(\frac{d_1 G_e}{\mu}\right)^{0.76}$ and $\left(\frac{h_s d_1}{k}\right)_{av}\left(\frac{C_p\mu}{k}\right)^{-1/3} = 0.00302\left(\frac{d_1 G_e}{\mu}\right)^{1.107}$ for the 9-inch and the 4-inch baffle spacings. These equations showed slight deviation from those of Lee in the range of investigation. This deviation is explained by the compact geometry of the present work compared to that used by Lee. Baffle type II data were correlated with an equation $\left(\frac{h_s d_1}{k}\right)_{av}\left(\frac{C_p\mu}{k}\right)^{-1/3} = 0.0675\left(\frac{d_1 G_e}{\mu}\right)^{0.67}$ for the 9-inch spacing case. The effect of geometry on the exponent of the Reynolds number was studied. The local heat transfer data at the baffle center were correlated by the following empirical equation $\left(\frac{h_s d_1}{k}\right)_b\left(\frac{C_p\mu}{k}\right)^{-1/3} = 0.000327\left(\frac{d_e G_b}{\mu}\right)^{1.048}\left(\frac{d_1}{d_e}\right)^{2.81}$.

The effect of change of baffle-to-tube clearance on heat transfer coefficient was investigated. The flow zone between two baffles was analyzed on the basis of local Nusselt number distribution and from this four flow zones, as postulated by Lee were identified. The velocity in various channels between two baffles were calculated to show existence of cross flow in the tube bundle. The segmental baffle case (type III) was qualitatively compared to the data of Ambrose. The present data were lower compared to those of Ambrose. This is explained by the smaller tube diameter and pitch used in the present work. The pressure drop data obtained were correlated in terms of the orifice-pressure-drop function. The present data compared well with those of other investigators. On this basis, the flow through an annular opening may be predicted from a knowledge of the pressure drop.

23828 EFFECT OF LOCAL BOILING ON HEAT TRANSFER RATES INSIDE A VERTICAL ANNULUS WITH COOLANT MIXTURES OF DIFFERENT COMPOSITIONS UNDER LAMINAR AND TURBULENT FLOW CONDITIONS. Chillapalli Venkata Rao (Univ. of Delaware, Newark). Dissertation Abstr., 22: 3567(Apr. 1962).

The design and optimum operation of cooling jackets for liquid-cooled aircraft engines and rocket motors require an understanding of the heat-transfer characteristics of different types of coolant under various operating conditions. Because of the impracticability of obtaining fundamental heat-transfer data by the use of actual full-scale engines, a bench-rig apparatus designed for the simulation of the range of heat fluxes encountered in aircraft engines was employed to study local boiling as well as non-boiling heat-transfer rates under both laminar and turbulent flow conditions. The heat exchanger consists essentially of a thick-walled 1.635-in. OD by 0.98-in. ID copper tube 14.25 in. long surrounded by a 2.01-in. ID glass jacket by means of which visual observations could be made. The coolant flowing upward through the annulus was heated by steam condensing on the inside of the copper tube. The coolants studied were methanol, water and their mixtures. For non-boiling conditions, the turbulent flow data obtained could be fairly well correlated by the equation employed by Carpenter et al., predicted values being about 10% higher. Correlation of the laminar flow data required the use of a specially derived theoretical equation based on the actual velocity distribution in annuli. The laminar flow equation used by Carpenter et al., predicted values 25 to 30% higher. In the case of local boiling data obtained, when the local boiling effects were large in comparison with the convective heat-transfer effects, the heat-transfer rates were found to be independent of flow rates, coolant pressures, and degrees of subcooling and depend only on the temperature excess and coolants employed. With small local boiling effects, heat transfer rates were found to be affected by all of the operating variables mentioned above. The local boiling laminar flow data could empirically be correlated in a simple manner. A mechanistic picture of bubble formation, growth and collapse was proposed for the interpretation of local boiling data in general.

23829 THERMAL CONDUCTIVITY OF MULTILAYER ELEMENT. A. S. Trofimov. Inzhener.-Fiz. Zhur. Akad. Nauk Belorus. S.S.R., No. 4, 93-6(Apr. 1962). (In Russian)

Correlations of precise and approximate calculations of two-layer element thermal conductivity demonstrated a difference only in the initial time factor (in the examined case $\tau \leq 0.05$ sec). A quasi-stationary method (by exclusion of variables) is suggested in order to avoid cumbersome procedures inherent in the exact method. (R.V.J.)

23830 REACTOR COOLANT PROPERTIES TABLE. Leon Green (Brookhaven National Lab., Upton, N. Y.). Nucleonics, 19: 140-4(Nov. 1961). (BNL-5377)

Properties of coolants being considered for nuclear reactors are tabulated. It is intended that the properties, which are given at 1000°F unless otherwise specified, will permit the advantages and disadvantages of the coolant materials to be compared. Coolant materials were divided into 4 classes: aqueous and organic liquids, gases, liquid metals, and fused inorganic liquids. 105 references are included. (P.C.H.)

Instrumentation

Refer also to abstracts 23614, 23615, 23616, 23617, 23618, 23623, 23640, 23959, 24100, 24359, 24360, 24361, 24362, 24363, 24364, 24365, 24369, 24549, 24550, 24552, 24553, 24554, 24555, 24579, 24580, and 24650.

23831 (AD-269034) RESEARCH AND DEVELOPMENT ON THERMOCOUPLE ENERGY CONVERTERS (PHASE II). Quarterly Progress Report No. 2, July 12, 1961-October 1, 1961. W. J. van der Grinten (General Electric Co. Electronics Lab., Syracuse, N. Y. and General Electric Co. Light Military Electronics Dept., Utica, N. Y.). Nov. 1, 1961. Contract DA-30-069-501-ORD-3294. 16p.

Efforts are being made to develop techniques for fabricating, in quantity, good quality n- and p-type thermoelectric lead telluride cells and to assemble these cells to form thermoelectric devices which will meet the following requirements: each of the 2 thermocouple energy converters will consist of 9 couples and will have an output of 7.5 watts/cubic inch or better at a minimum load current of 20 amp when a temperature gradient of at most 600 K/cm exists across the thermoelectric material; the converters will be capable of operation with the hot side of the thermoelectric material near its melting point (917°C) and the performance indicated should be attainable at a hot side temperature of at least 1000°K; and the devices should be operable for a minimum of one hour. Effort resulted in perfecting the casting technique so that n- and p-type cells can be manufactured in quantity. Also, the design and fabrication of the complete cell assembly including a hermetic seal at the cold junction side, having a maximum temperature capability of 780°C, was realized. (auth)

23832 (AD-269867) RESEARCH AND DEVELOPMENT OF A PROTON SPECTROMETER. Semiannual Technical Report, January 1-June 30, 1961. F. S. Mozer, D. D. Elliott, and A. F. Lawrence (Aerospace Corp., El Segundo, Calif.). Contract AF04(647)-594. 48p. (TDR-594(1245-01)TR-1)

A proton spectrometer system was developed to measure the flux and energy spectrum of protons above 1 Mev in the Van Allen radiation belts and interplanetary space. The instrument will be flown on the Advent satellite and other vehicles to obtain information pertinent to reliability of satellite components in the space environment. (auth)

23833 (AEET/AM/24) CALIBRATION OF G.M. COUNTERS FOR DIRECT COUNTING OF RADON IN THE ATMOSPHERE. V. V. Shirvaikar and R. N. Sachdev (India. Atomic Energy Establishment, Trombay). 1961. 15p.

An experiment for the direct calibration of a Geiger counter immersed in a balloon containing a known concentration of radon in equilibrium with its daughters was conducted. A theory was developed for finding out the geometrical efficiency of the counter used in this way and for checking the experimental results with theoretical efficiency. (N.W.R.)

23834 (AERE-M-1014) AN INVESTIGATION OF THE DIFFUSION OF ELECTRO-MAGNETIC FIELDS IN A STATIONARY CONDUCTING MEDIUM BY MEANS OF EQUIVALENT NETWORKS. A. H. Read (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Mar. 1962. 25p.

The equations giving the spatial variation of voltage and current along a resistance-capacitance line were derived. These were compared with the equations giving the one dimensional diffusion of electric and magnetic fields through conducting media. Two problems involving the pressure resulting from these fields were then examined, and the implications of the results are discussed. (auth)

23835 (AFOSR-2665) TABLES OF THE TRANSVERSE MAGNETIC COEFFICIENTS K(γ) AND L(γ). Technical Note No. 6. Peter V. Gray (Illinois. Univ., Urbana. Electrical Engineering Research Lab.). Apr. 30, 1962. Contract AF49(638)-417. 13p.

Tables of transverse magnetic coefficients K(γ) and L(γ), as defined by Willardson, Harman, and Beer, are given over the range in which simple (high and low field) approximations are not valid. The tables permit easy multi-band calculation of the transverse magnetoresistance and isothermal Hall coefficient in non-degenerate semiconductors in the lattice scattering range. (auth)

23836 (AFSWC-TDR-62-25) ROCKET-BORNE MAGNETOMETER. Final Report. Robert Morris (Varian Associates, Palo Alto, Calif.). Jan. 1962. Contract AF29(601)-2599. 25p. (ER-270-1F).

A summation of the theory, design, and successful operation of two rocket-borne, wide-range Rb-vapor magnetometers is presented. Each dual-gas-cell instrument will operate continuously in ambient magnetic fields ranging in intensity from less than 100 gammas to more than 54,000 gammas. The constant-amplitude output signal varies in frequency directly with ambient field strength. Sensitivity is dependent upon the Rb isotope employed. One magnetometer provides 6.99 cps/gamma, the other 4.67 cps/gamma. Self-oscillation was achieved in fields greater than 1 oersted (100,000 gammas). Each instrument responds instantaneously (within limits of experimental error) to a step change in field intensity of several hundred gammas occurring in less than one microsecond. (auth)

23837 (ARL-62-315) RESEARCH IN HIGH-TEMPERATURE X-RAY DIFFRACTION TECHNOLOGY. S. M. Lang and E. W. Franklin (Owens-Illinois Glass Co., High-Temperature Lab., Toledo, Ohio). Mar. 1962. Contract AF33(616)-7470. 105p.

A study resulted in the assembly of an inductively-heated high-temperature x-ray diffractometer furnace that operates with an unmodified Norelco high-angle goniometer spectrometer. The design criteria, the various feasibility trials, and the general features of the instrument are discussed. (auth)

23838 (BNL-737) SILICON SURFACE BARRIER $\Delta E/\Delta x$ DETECTORS FOR NUCLEAR REACTION STUDIES.

J. F. Mollenauer, S. Wagner, and G. L. Miller (Brookhaven National Lab., Upton, N. Y.). May 15, 1962. Contract [AT(30-2)-Gen-16]. 14p.

Simple procedures involving only standard laboratory equipment are given for the fabrication of silicon surface barrier particle detectors with thicknesses of 0.6 to 2 mils and areas of 20 to 100 mm^2. These detectors are fabricated from 400 or 1500 Ω-cm n-type silicon wafers with evaporated gold front contacts and evaporated aluminum back contacts. The resolution obtained is limited as much by statistical effects as by thickness variation for counters thinner than 1 mil. (auth)

23839 (CEA-2082) MICROSCOPIE A HAUTE TEMPÉRATURE (THÈSES). (High Temperature Microscope (thesis)). Pierre Rousseau (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1961. 73p.

Submitted to Université, Paris.

A microscope for observing radioactive metallic samples at high temperature and low pressure is described. The operating conditions are as follows: to limit oxidation of the metal, pressure of about 10^{-6} mm of Hg is maintained in the furnace, an ultra vacuum device could be used; working temperatures range between room temperature and 1200°C; furnace temperature is regulated; observation is in polarized light or interference contrast; and to insure protection of the operator, the apparatus is placed in a glove-box. The $\alpha \nearrow \beta$, $\beta \nearrow \gamma$ transformations of uranium were observed with the microscope. (auth)

23840 (CEA-2138) RESULTATS EN SPECTROMETRIE α A L'AIDE DE "DETECTEURS JONCTION." (Results obtained in α Spectrometry using Junction Detectors). H. Beaumevieille, J. Fontenille, J. P. Longequeue, N. Longequeue, and C. Rabour (Grenoble, France. Université. Laboratoire de Physique Nucléaire). 1962. 12p.

Junction detectors were used for studying α spectra obtained by reactions (p,α), the protons being produced by an electrostatic accelerator (E_p varying from 100 to 600 kev). Difficulties were encountered arising from parasitic noise from the accelerator and from the distance (60 meters) between detectors and electronic equipment. Resolution of the counter were found to be 0.6% with α from Po^{210} and 1.2% with α (5, 8 Mev) from the reaction $B^{11}(p,\alpha_0)$. (auth)

23841 (CEA-2162) DETERMINATION DES FLUX PAR ELECTRON-VOLT A L'ENERGIE DE RESONANCE DE L'OR A L'AIDE DE DETECTEURS D'OR EPAIS. (Determination of the Flux Per Electron-Volt at the Resonance-Energy of Gold by Means of Thick Gold Detectors). J. Brisbois and G. Fogagnolo (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Fontenay-aux-Roses). 1962. 25p.

The coefficients which allow determining a neutron flux at 5 ev by means of 2/10 mm thick gold detectors on Geiger-Mueller counter assemblies are calculated. These coefficients were obtained comparing the thick detectors with the thin ones. (auth)

23842 (CREL-952) MULTIPURPOSE READOUT SCALER. L. B. Robinson (Atomic Energy of Canada Ltd., Chalk River Project, Chalk River, Ont.). Mar. 1962. 44p. (AECL-1491)

A multipurpose scaler base unit is described which provides increased versatility through more effective use of the modular plug-in circuit approach. The unit is a useful building block for automatic counting systems and contains circuitry needed for coupling to electromechanical parts such as sample changers. It also simplifies the addition of scaling capability to kicksorter readout systems. Any number of the base units can be coupled to form a counting system of any desired capacity; reading out with an electric typewriter or paper-tape punch. By choice of suitable standard plug-in units, resolving times as low as 0.25 μs may be obtained. A wired program plug can be readily modified by the operator to change readout format and counting sequences. (auth)

23843 (CREL-1009) A DATA PLOTTING SYSTEM FOR USE WITH PUNCHED PAPER TAPE. PART 1. GENERAL DESCRIPTION. J. A. Ladd and A. J. S. Davidson (Atomic Energy of Canada Ltd., Chalk River, Ont.). May 1962. 31p. (AECL-1530)

A system designed for the conversion of punched paper tape information into linear or logarithmic graphical form is described. The equipment is primarily intended for use with the tape output from Chalk River pulse amplitude analyzers, but may be adapted for other formats. Any standard commercial X-Y plotting table may be used, and the accuracy is about 0.2% of full scale on both axes for the linear mode. Five decades are covered in the logarithmic mode, the accuracy then being 1 to 2% of reading, with a resolution of three figures. The unit has a capacity of up to three digits (0-999) in the Y direction and two digits (1-100) in the X direction. The time required for a typical 100-channel spectrum plot is 45 to 50 seconds. This part of the report deals with the general principles of operation and Part II contains complete circuit descriptions and diagrams. (auth)

23844 (NDL-TR-20) AN INITIAL GAMMA-RAY SPECTROGRAPH. W. R. Van Antwerp (Army Chemical Corps Nuclear Defense Lab., Army Chemical Center, Md.). Feb. 1962. 112p.

A gamma-ray spectrograph based on the magnetic analysis of Compton electrons is described. Use of the natural focal properties of uncollimated Compton electrons in a semicircular beta-ray spectrograph is proposed and theoretical and experimental results on the performance of such an instrument are presented. (auth)

23845 (NP-11734) DEMOLTIPLICATORI E PRESELETTORI DI IMPULSI. (Pulse Scalers and Preselector Counting Circuits). A. Mauti and A. Serra (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratorio di Elettronica, Rome). May 1962. 15p. (RT/EL(62)5)

Some scalers, with ~0.6 μs, ~8 μs, and ~0.5 ms dead times, are described. Two preselectors are also presented, which can preselect with continuity a number of pulses between 001 and 999. (auth)

23846 (ORNL-TM-137) NUCLEAR INSTRUMENTATION FOR SCINTILLATION AND SEMICONDUCTOR SPECTROSCOPY. T. L. Emmer (Oak Ridge National Lab., Tenn.). May 3, 1962. Contract [W-7405-Eng-26]. 29p.

A manual is presented for those who use or service the transistorized instruments for nuclear spectroscopy: the transistor amplifier; the snip-snap single-channel analyzer; the fast coincidence unit; and the biased amplifier and linear gate. A general description is given for each instrument along with the specifications, a description of the circuit, and a procedure for initial testing. (auth)

23847 (SCTM-16-62(11)) PHOTOGRAPHIC EMULSION CALIBRATION. M. M. Robertson and H. G. Palmer (Sandia Corp., Albuquerque, N. Mex.). Feb. 1962. Contract [AT(29-1)-789]. 18p.

Factors affecting photographic emulsion response are investigated, and a method is developed for calibrating emulsion intensity and wavelength response for application

to spectroscopic plasma jet temperature determinations. (auth)

23848 (SCTM-326-61(14)) STATISTICAL EVALUATION OF SCINTILLATION SYSTEMS. R. M. McGehee (Sandia Corp., Albuquerque, N. Mex.). Jan. 1962. Contract [AT(29-1)-789]. 21p.

A method of analyzing a neutron flux measuring system is presented in which the contribution to over-all uncertainty of measurement of each element is derived. The individual relative variances are shown to add algebraically. Experiments are outlined by which the individual system components may be evaluated and optimized. (auth)

23849 (TID-15746) CONSTRUCTION AND CALIBRATION OF NEUTRON LONG COUNTER (thesis). Robert Winfield Wood (Vanderbilt Univ., Nashville). June 1955. 33p.

A counter was constructed for studies of neutron scattering which will give the flux of neutrons at any given angle with respect to the incident neutron direction and which will not require energy correction. The neutrons were produced by deuteron bombardment of deuterium. The counter used consisted essentially of a neutron detector embedded in paraffin. The detector is a BF_3 proportional counter. The initial calibration of the counter was made using a Po–Be source. In addition, a study of neutron scattering from a cement floor was made using the Po–Be source. (M.C.G.)

23850 (TID-16074) PROGRESS REPORT AND RENEWAL PROPOSAL FOR A RESEARCH PROGRAM IN EXPERIMENTAL AND THEORETICAL HIGH ENERGY PHYSICS. David Feldman and Anatole M. Shapiro (Brown Univ., Providence). June 1, 1962. Contract AT(30-1)-2262. 24p.

Work in the bubble and spark chamber research program was devoted to analyses of existing film, experimental runs at BNL, and design and construction for future experiments. Activities in the nuclear emulsion research program were devoted primarily to study of the processes through which 4.5-Bev negative pions interact with nuclear matter by analysis of nuclear emulsion stars produced by those mesons. Other effort in this program was devoted to developing a proton beam suitable for measuring the p-n cross section by a Chew-Low analysis of the distribution in angle and energy of the spectator protons from the reactions $p + d \rightarrow p + n + p$. The status of various theoretical programs in the areas of high-energy nuclear physics, meson physics, and quantum field theory is reported. A list of papers published during the report period is included. (J.R.D.)

23851 (UCRL-10109) SMP-1 SCANNING AND MEASURING PROJECTOR. Luis W. Alvarez, Peter Davey, Robert Hulsizer, James Snyder, Arnold J. Schwemin, and Ronald Zane (California. Univ., Berkeley. Lawrence Radiation Lab.). Apr. 10, 1962. Contract W-7405-Eng-48. 31p.

An instrument for scanning and measuring bubble chamber film, the SMP (described at the 1960 conference on high-speed film measuring devices), was built and tested. The design of this prototype is described, and a proposal is presented for a data analysis system that would use several SMP's connected on-line to a high-speed computer. The prototype has several features, that were developed since the Brookhaven Conference, that simplified its operation. Tests of the prototype connected to an IBM 709 computer demonstrated the feasibility of this mode of operation, showed that the instrument is capable of detecting bubbles even on low-quality film, and showed the measurement accuracy to be 1μ in determining the position of a fine wire and 6μ in determining the location of a 6-mm-long segment of a bubble chamber track whose bubbles are 30μ in diameter. The organization of a computer program is described that is capable of ingesting, checking, and analyzing the data from at least three SMP's simultaneously operating on-line to an IBM 709 computer. (auth)

23852 (UTIA-TN-26) A HIGH-SPEED MULTI-SOURCE SPARK CAMERA. J. H. deLeeuw, I. I. Glass, and L. E. Heuckroth (Toronto. Univ. Inst. of Aerophysics). Feb. 1962. 62p.

Details are given of the design, operation, and applications of an eight-channel Cranz-Schardin type high-speed multiple spark source camera suitable for optical studies of nonstationary flow phenomena in gases and transparent liquids and solids. The camera was successfully applied to the investigation of cylindrical and spherical explosions and implosions, underwater blasts, stress waves in plastics, and impact in glass panels. (auth)

23853 (WADD-TN-60-307) RESEARCH ON ELECTRON BOMBARDMENT INDUCED CONDUCTIVITY TARGETS IN CAMERA TUBES. J. Lempert and G. Klotzbaugh (Westinghouse Electric Corp. Research Labs., Pittsburgh). Nov. 15, 1960. Contract AF 33(616)-6496. 70p. (AD-269134)

A method for calculating the resolution capabilities of a camera tube as a function of input illumination and tube design parameters is described. A description of experimental work on a successful method for obtaining a high minification image in a combination magnetic and electrostatic focused image tube is given. Results of an investigation of different target materials of the electron-bombardment-induced-conductivity type are reviewed. The construction and test of experimental camera tubes, consisting of high voltage variable-minification image sections, high gain targets of the electron-bombardment-induced-conductivity type, and scan sections with return beam multipliers, are discussed. (auth)

23854 (WT-543) THERMAL RADIATION FROM A NUCLEAR DETONATION. A. Broido, C. P. Butler, R. P. Day, R. W. Hillendahl, S. B. Martin, and A. B. Willoughby (Naval Radiological Defense Lab., San Francisco). Mar. 1953. Project 8.3 of OPERATION TUMBLER-SNAPPER. 98p.

Measurements of thermal radiation from four nuclear detonations at Operation Tumbler-Snapper are described. Data were obtained from ground zero to 20,000 ft. The instruments used included disk calorimeters, passive receivers, photronic cells, radiometers, and sphere calorimeters. The results show the relation between weapon yield and such factors as total thermal energy at any distance, maximum intensity and duration of the thermal pulse, thermal efficiency of the weapons (ratio of thermal yield to total yield as determined by radiochemical analysis), and the amount of local obscuration caused by the thermal radiation and blast wave. The data indicate a decrease in thermal efficiency with increasing weapon yield, ranging from about 44% at 1 KT to about 34% at 30 KT. The time to the second maximum of the thermal pulse ranges from approximately 100 msec for a 1 KT weapon to about 200 msec for a 30 KT detonation. The spectral measurements indicate that the thermal radiation arriving at the measuring stations peaks in the visible region, with about 10% of the energy in the wave length region below 3600 Å and about 25% in wave lengths beyond 9500 Å. Total thermal radiation measurements made near ground level

indicate that, even before the arrival of the shock wave, serious obscuration is produced by such effects of the radiation as "popcorning" of sand, and smoke produced by the burning of ground litter. The thermal energy received by aircraft flying above the detonation was appreciably greater than that received at equivalent distances along the ground. This increase is primarily due to reflection by the ground. (auth)

23855 (WT-544) THERMAL RADIATION MEASUREMENTS USING PASSIVE INDICATORS. L. Banet, P. Grinoch, A. Hirschman, and T. I. Monahan (Naval Material Lab., Brooklyn). Feb. 1953. Project 8.3a of OPERATION TUMBLER-SNAPPER. 12p.

The use of a passive-type instrument to measure the radiant exposure at a distance from a nuclear detonation was investigated at Operation Tumbler-Snapper. The basic principle of the instrument involves the dependence of thermal damage on the orientation of a heat-sensitive material's surface with respect to the incident radiation. At a given distance, the incident energy on the surface exceeds the radiant exposure required to produce characteristic damage on the material for all angles up to the threshold angle. The energy incident on the normal surface is the energy required to produce the damage divided by the cosine of the threshold angle. In the instrument evaluated, the sensitive materials employed were black carbon paper and black matte paper, with special paint striped to form windows and prevent the propagation of flame from one window to an adjoining window. The results of the experiment indicate that the response of the matte paper was in agreement with the radiant exposure values determined with calorimeters, while the black carbon paper gave approximately one-half the calorimeter value. Reasons for the failure of the carbon paper are discussed. The direction of the fireball was accurately determined on the basis of data at two stations. The data at the third station gave an inaccurate indication of the fireball's direction but inaccurate mounting of the indicator was probably responsible for this error. (auth)

23856 (WT-790) AEC SHELTER INSTRUMENTATION. E. W. Ruhl, et al. (Vitro Corp. of America, New York). Aug. 1953. Project 24.3 [of] Operation UPSHOT-KNOTHOLE. 138p.

Data was obtained on various blast phenomena near and within two communal shelters. An instrumentation system was designed and constructed for measuring five basic physical quantities: overpressure, acceleration, internal displacement, strain, and air temperature. Good pressure records were obtained which show not only the maximum pressures at various locations within the shelters but also a clear picture of the pressure differences resulting from the two shelter designs and the mode by which the pressure waves were amplified or attenuated. Although many of the temperature measurements did not produce significant results, many valuable data on this effect were obtained. Also presented are records of strain, displacement, and acceleration for one test. These records serve to define the secondary effects of the blast. (auth)

23857 (Y-1393) AN IMPROVED MASS SPECTROMETER ANALYZER TUBE ASSEMBLY. W. W. Rice (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.) and A. E. Cameron (Oak Ridge National Lab., Tenn.). May 25, 1962. Contract W-7405-Eng-26. 21p.

An improved 6-inch radius, 60-degree sector, single-focusing mass spectrometer analyzer tube assembly was designed and fabricated. The tube is constructed by a new "wave guide" fabrication technique and is designed to be completely rigid and to maintain precise tube alignment. The assembly is differentially pumped and equipped with an isolation valve which is positioned directly beneath the ion source chamber. A pneumatically operated vacuum lock is attached to the assembly. The detector housing is adaptable to an electron multiplier and/or a vibrating reed electrometer. (auth)

23858 (AEC-tr-5120) TEMPERATURE DEPENDENCE OF SCINTILLATION DETECTORS. Jiri Skrivanek and Marie Vesela. Translated from Československ. časopis pro fysiku, 10: 312-15(1960). 5p.

The temperature dependence of efficiency was measured for detectors with organic and inorganic scintillators. In the range from 5 to 40°C, the coefficients of the organic scintillators were negative and the dependence of NaI(Tl) on the spectrum was reciprocal. The form of the amplitude spectrum of the scintillator ZnS(Ag) + paraffin did not vary with temperature. The temperature coefficients of the photomultipliers were negative in the range measured. (auth)

23859 (CEA-tr-A-1119) LA RELATION ÉNERGIE-PORTÉE DANS L'ÉMULSION NUCLÉAIRE AGFA K-2. (The Range-Energy Relation in AGFA-K2 Nuclear Emulsions). D. Bebel. Translated into French by L. Bory from Ann. Physik, (7), 5: 144-56(1960). 31p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 13075.

23860 (CEA-tr-A-1122) CHOIX DE L'ISOTOPE LE PLUS APPROPRIÉ ET DE L'INTENSITÉ DE SOURCE SUFFISANTE POUR UN PROBLÈME DONNE DE DIFFERENCE DE MASSES. (The Selection of a Suitable Isotope and Satisfactory Source Strength for a Given Mass Difference Problem). P. Platzek (Platzec) and J. Krugers. Translated into French from Kerntechnik, 3: 71-3(Feb. 1961). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, as abstract no. 15931.

23861 (CEA-tr-A-1126) L'AMPLIFICATEUR MAGNETIQUE DANS L'EQUIPEMENT DU REACTEUR. (A Magnetic Amplifier in Reactor Instrumentation). P. P. Schranz and A. Stebler. Translated into French by J. Bonnet from Kerntechnik, 2: 408-10(Dec. 1960). 12p. (Includes original, 3p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 9111.

23862 (SCL-T-419) OPERATING INSTRUCTIONS PAMPHLET. ROTATING COIL INDICATORS TO BE CONNECTED WITH: THERMOCOUPLES, PYRRADIO, GAS ANALYZERS, HUMIDITY SUPPLIERS WITH THERMOBATTERY, pH ELECTRODES, AND MEASURING VALUE TRANSFORMERS. (Gebrauchsanweisung: "Drehspul-Anzeigeinstrumente zum Anschluss an: Thermoelemente, Pyrradio, Gasanalysatoren, Feuchtegeber mit Thermobatterie, pH-Elektroden, Messwertumformer"). Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.) from a publication of Hartmann & Braun AG (H&B), Frankfurt/Main, West Germany. 1960. 6p.

Operating instructions are given for rotating coil indicators. Topics covered include: transportation, installation, zero point control, connection and balancing of the measuring lines, and maintenance during operation. (M.C.G.)

23863 PHOTOMULTIPLIERS IN EXPERIMENTAL PHYSICS—PROBLEMS ENCOUNTERED IN DESIGN,

PRODUCTION, AND USE. G. Pietri. Acta Electronica, 5: 7-30(Jan. 1961).

The use of photomultipliers for determining with accuracy the instant luminous phenomena occurs is discussed. The operating principles of the photomultiplier are outlined, leading to an examination of the problems encountered in the production of these tubes and their operational limits. The components of a typical photomultiplier and conditions for obtaining optimum efficiency are described. An appendix gives the calculation of the response of the electron optical system of photomultipliers in pulsed operation. (OID)

23864 DESIGN OF A FAST-RESPONSE PHOTOMULTIPLIER. M. Barbier. Acta Electronica, 5: 31-8(Jan. 1961).

The time flight differences of electrons in photomultipliers are due to the different path lengths as well as to the different initial energies of the electrons. The first effect can be minimized by the method of construction, while the influence of the second effect can be reduced by using accelerating grids so that the electrons travel most of the time with their maximum speed. Therefore, it would be possible to build photomultipliers with a rise time shorter than 10^{-10} sec. (OID)

23865 SOME CONSIDERATIONS CONCERNING THE PERFORMANCES OF FAST RESPONSE PHOTOMULTIPLIERS. C. Cernigoi, I. Gabrelli, and G. Iernetti. Acta Electronica, 5: 53-60(Jan. 1961).

Criteria for determining photomultiplier response are given, and experimental methods for studying the output pulses of these tubes are described briefly. The results obtained with 4 types of fast response photomultipliers are used for comparing performances and as a guide for choosing the tube according to the application considered. (OID)

23866 A SEMIAUTOMATIC MEASURING APPARATUS FOR GAMMA ACTIVITY COMPARISON WITH IONIZATION CHAMBERS. R. Hoehle, E. Suschke, and W. Zimmermann (Institut fÜr Angewandte Radioaktivität, Leipzig). Atomkernenergie, 7: 216-21(June 1962). (In German)

A report is made on a semi-automatic measuring instrument for the activity comparison of ionization chambers. By using the discharge method, the instrument makes possible the automatic registration of any number of individual electrometer expiration times with a margin of error of 0.1 s. (auth)

23867 A METHANE-FILLED SPARK COUNTER. Hans-Joachim Belitz (Universität, Giessen). Atomkernenergie, 7: 221-3(June 1962). (In German)

Signs of aging in non-corona spark counters of the Rosenblum type (thin anode wires in front of a flat cathode plate) containing CH_4 and other organic gases as counting gas can only be avoided in counters which are filled with non-soot-forming gases. A report is made on the counting properties of such counters with methane gas filling. The constancy of the counting rate is better than in the case of the counter with a CH_4 filling; response capacity and discrimination between fast neutrons and γ rays are not different from those of a counter operated with methane. (auth)

23868 CONTINUOUS MEASUREMENT OF SMALL ACTIVITY CONCENTRATIONS IN WATER FOLLOWING CONCENTRATION COMPARED TO CONTINUOUS DIRECT MEASUREMENT. Klaus Haberer (Technische Hochschule, Karlsruhe, Ger.). Atomkernenergie, 7: 229-33(June 1962). (In German)

Devices for continuous measurement of radioactivity in water following continuous concentration are mentioned and compared with various devices for direct measurement of water activity. By means of the calculated sensitivity curves depending on the maximum energy of β-emitters the applicability of the devices is discussed to assay the specific activity of (a) known single nuclides in sewage, (b) known mixtures of β-emitters with nearly equal energies which the mixed fission products possibly may be counted to, (c) unknown mixtures of unidentified nuclides. It is shown that for cases (a) and (b) a direct measurement mostly is possible, however for case (c) a concentration of the radionuclides is required. (auth)

23869 SIMPLIFICATION OF DOSE-MEASURING FILM EVALUATION BY FIXING-DEVELOPERS. K. Becker (Kernforschungsanlage, Jülich, Ger.). Atomkernenergie, 7: 234-5(June 1962). (In German)

Monobath fixing-developers facilitate the essential simplication of dosimeter film wet processing, especially in cases of catastrophes: 1) No rinsing, no fixation, 2) above a minimum time the received photographic density is independent from developing time 3) temperature dependence is less than half as marked in conventional development. Monobath development does not influence dependence of energy concerning the film sensitivity; maximum density is about 30 p.c. below conventional development. (auth)

23870 SEMICONDUCTORS AS RADIATION DETECTORS. H. Clay Gorton. Battelle Tech. Rev., 11: No. 7, 3-7(July 1962).

Nuclear radiation progressively modifies some of the physical and electrical characteristics of semiconductors. Devices made from semiconducting materials are studied as mechanisms to detect radiation and provide continuing records of radiation dosages in health-physics applications. (auth)

23871 THE ASSEMBLY AND OPERATING CHARACTERISTICS OF A 4 PI LIQUID SCINTILLATION DETECTOR. Billy Glenn Dunavant (Purdue Univ., Lafayette, Ind.). Dissertation Abstr., 22: 3615(Apr. 1962).

A 4 pi liquid scintillation detector of new design was assembled. A study was initiated to determine the applicability of the detector and its associated electronics to biological and medical research. The investigation was divided into two phases: (1) assembly and determination of the operational characteristics of the detector and its associated electronics; and (2) a study of the application of the detector to retention and excretion of various Fe^{59} medicament forms of iron. The detector had a scintillator volume of one cubic foot and a sample chamber 4.25 inches in diameter and 8 inches long. Four 5-inch photomultiplier tubes provided a photocathode coverage of 10 per cent of the detector's total wall area. Good light collection efficiency was evidenced by the fact that the counting efficiency remained relatively constant when a point source of a gamma emitter was moved along the central axis of the sample chamber away from the photomultiplier tubes. The detector was housed in an iron shield which provided 5 inches of shielding. The electronics used with the detector consisted of a conventional preamplifier, a high-gain pulse amplifier, a modified single channel pulse-height analyzer, a scaler, a high voltage supply, an electronic spectrum scanner, a chart recorder, and a high voltage distribution panel. The detector system proved efficient for measuring gamma radiation at the submicrocurie level both by integral and differential counting; however, the differential response of the detector is not adequate for precise energy discrimination unless the gamma-ray energies differ by a factor of two or more. A retention

and excretion study of three iron salts (ferrous gluconate, ferrous sulfate, and ferric sulfate), which were labeled with Fe^{59} and administered orally and intraperitoneally to mice, was chosen to provide additional information about these salts and to illustrate the applicability of the detector to biological and medical investigations of this type. The radioiron was measured in each animal by placing the animal in the detector. Since the instrument made it possible to do so, in vivo counting was performed repeatedly in order to permit serial observations on the same animal over several weeks time. Within 36 hours following intraperitoneal injection of the Fe^{59}-labeled iron salts, there was a loss of from 3.5 to 14.8 per cent of the administered dose; thereafter, the loss decreased and followed an exponential pattern over the period of time of the study. Twenty hours following oral administration of the Fe^{59}-labeled iron salts, from 90.4 to 92.4 per cent of the administered dose was excreted.

23872 THE PRINCIPLES OF THE NUCLEAR RADIATION MEASURING TECHNIQUE. L. Weise. Feinwerktechnik, 64: 173-83(May 1960).

This part of a series of articles on the principles of radiation measurements deals exclusively with radiation detectors. Types of radiation and ways to differentiate between the radiation, penetrating powers, and the basic concepts of detector systems are discussed. The statistics governing nuclear decay and the time element of their measurements are explained, and mathematical formulas are presented. The following sections deal with these subjects: ionization chambers (including discussions of dose units and ionization chambers with air or texture walls), proportional counters, Geiger-Müller counters, scintillation counters, and neutron detectors. Each type of apparatus mentioned is illustrated with photographs of instruments manufactured by the firm Frieseke und Hoepfner, Erlangen, West Germany. (OID)

23873 THE PRINCIPLES OF THE NUCLEAR RADIATION MEASURING TECHNIQUE. L. Weise. Feinwerktechnik, 65: 75-84(Mar. 1961).

This second part of a series of articles on instruments for radiation measurements is devoted to pulse-processing apparatus. A general survey is given on the theory underlying isotope activity measuring machinery, including short discussions on one-channel analyzers, multi-channel analyzers, and the gray-wedge spectrometer. The theoretical basis of pulse amplification and pulse formation are discussed, and formulas are given. Digital counting circuits are used to supplement electromechanical counters which are in general too slow to register the pulse sequences. The electron beam tube E1T manufactured by Philips and the decatron of the Ericson Telephone Co. are described. Circuit diagrams and mathematical formulas are discussed for integrating circuits and a special type, logarithmic integrating circuit. The practical applications in the laboratories have called for the development of combined instruments, which contain scaler and ratemeters, and regulating provisions for selecting pulse rates and time intervals. A circuit diagram and a picture of a Frieseke and Hoepfner GmbH instrument explain modern trends and designs. Coincidence and anticoincidence methods, and gate connections are discussed, and diagrams and formulas are given. (OID)

23874 THE MEASUREMENT AND ANALYSIS OF NUCLEAR RADIATION WITH MODERN MEASURING INSTRUMENTS. PARTS I AND II. U. Dreutler. Glas.-Instr.-Tech., 5: 459-62(Dec. 1961); 6: 44-51(Feb. 1962).

The present status of nuclear radiation measuring apparatus is reviewed. After a short summary of the theoretical aspects of counting tubes, their construction and operation are discussed in detail. Scintillation counters which have greater sensitivity to γ radiation and better time resolution are discussed. A detailed description is given of various types of scintillation counters, which consist of the scintillation crystal, the amplifier for secondary electrons, the photomultiplier, and the recording instrument. CsI(Tl) or NaI(Tl) salts or the crystals of the organic compounds anthracene, stilben, or naphthalene are used as scintillators. Scintillation counters require adequate shielding against background radiation because of their great sensitivity. (OID)

23875 ELECTRONICS FOR WHOLE-BODY LIQUID SCINTILLATION COUNTERS. R. D. Hiebert and J. D. Gallagher (Los Alamos Scientific Lab., N. Mex.). IRE Trans. on Bio-Med. Electron., BME-9: No. 1, 54-61(Jan. 1962).

Large liquid scintillation counters offer high sensitivity and moderate energy resolution and hence are particularly useful for the rapid measurement of the radioactivity of the human body and other large samples. This counter permits measurements of internal gamma contamination of the human body at concentrations 1000 times less than maximum permissible levels. The instrumentation described is used with the new Los Alamos human counter but the techniques are applicable to large liquid scintillation counters in general. Objectives in this system are: optimizing pulse-height (energy) resolution from the detector; optimizing SNR; long-term stability and freedom from rate and overload deficiencies; and accuracy, speed, and versatility of data handling and processing. (auth)

23876 PROCEEDINGS OF THE EIGHTH SCINTILLATION COUNTER SYMPOSIUM, WASHINGTON, D. C., MARCH 1-3, 1962. IRE Trans. on Nuclear Sci. NS-9, No. 3, 1-416(June 1962).

A total of 64 papers are included which are divided into sections dealing with scintillators, photomultipliers and image tubes, semiconductor detectors, scintillation track imaging, spark chambers, counter systems, and space applications. Separate abstracts were prepared for 55 of these papers, while 4 were previously abstracted in NSA. (D.L.C.)

23877 RECENT DEVELOPMENTS IN ALKALI HALIDE SCINTILLATION CRYSTALS. W. W. Managan (Harshaw Chemical Co., Cleveland). IRE Trans. on Nuclear Sci. NS-9, No. 3, 1-15(June 1962).

The intrinsic resolution or minimum line width attainable in NaI(Tl) spectrometers can now be set at 5 to 6% for 662 kev gamma rays from Cs^{137}. Work leading to this conclusion is reviewed. Pressure effects and directional effects in sodium iodide which support the exciton energy transport theory (Seitz model) are reported. Also, decay time, temperature coefficient (−0.12%°C), and non-proportional scintillation response in NaI(Tl) are reported. Studies of the CsI(Tl) emission spectra and decay time constants as functions of temperature and dE/dx are reported. Separation of alpha from gamma-ray events by color discrimination as well as by pulse shape discrimination is described. A statistical method of measuring decay time constants over a wide range of intensity during decay is presented. (auth)

23878 THE SCINTILLATION BUBBLE CHAMBER. Richard H. Milburn (Tufts Univ., Medford, Mass.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 16-21(June 1962).

An additive was found which converts liquid propane into

a liquid scintillator solution. This solution was used in a bubble chamber to associate photographed interactions in the chamber with externally developed coincidence pulses. Techniques and applications are discussed. (auth)

23879 RESPONSE OF NaI(Tl) TO X-RAYS AND LOW ENERGY GAMMA RAYS. W. C. Kaiser, S. I. Baker, A. J. MacKay, and I. S. Sherman (Argonne National Lab., Ill.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 22-7(June 1962). (AAC-6145)

A thorough investigation of the response of NaI(Tl) in the region below 50 kev was made using a continuous distribution of x rays from a tungsten target as well as monoenergetic gamma rays from radioactive sources. The results of this investigation agree well with those of Engelkemeir. The investigation also showed that below 20 kev NaI(Tl) is sensitive to surface treatment. Above 20 kev, the response is independent of surface treatment as long as the surface is free of moisture. An electron response curve is shown which, when used with the decay scheme of the excited iodine atom, predicts the observed nonlinear response NaI(Tl) to low energy x and γ rays. (auth)

23880 EFFECT OF DELTA RAYS ON THE RESPONSE OF INORGANIC SCINTILLATORS TO HEAVY PARTICLES. R. B. Murray and A. Meyer (Oak Ridge National Lab., Yale). IRE Trans. on Nuclear Sci. NS-9, No. 3, 33-5(June 1962).

Experimental results from Yale indicate that the scintillation efficiency of inorganic crystals to heavy particles is not a function of dE/dx alone but is instead composed of a series of discrete functions, one for each incident particle. An analysis of these experimental results is presented with attention to the effect of delta rays produced by the primary particle. In this treatment, the total light emitted per unit path length of the primary is the sum of two contributions: one from the saturation column of the primary particle, and one from those energetic secondary electrons (delta rays) which escape the saturation column and produce light with a high efficiency. (auth)

23881 RESOLUTION AND LINE SHAPE IN SCINTILLATION COUNTERS. J. R. Prescott and P. S. Takhar (Univ. of British Columbia, Vancouver). IRE Trans. on Nuclear Sci. NS-9, No. 3, 36-45(June 1962).

An experimental study was made of some factors that determine the pulse height resolution of scintillation counter assemblies. A statistical model is developed from which an analytic expression for the ideal line shape is obtained. Excellent agreement is found with observations using an artificial light pulser. A comparison is made between non-crystalline organic scintillators and a sodium iodide crystal of similar size. It is shown that for gamma-ray detection, an important contribution to line-width originates with variations in the light collection efficiency from different regions of the scintillator. (auth)

23882 THE EFFECT OF DISLOCATION DENSITY ON THE ENERGY RESOLUTION OF SODIUM IODIDE SCINTILLATORS. I. Cooke and L. D. Reed (Univ. of Manitoba, Winnipg, Can.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 46-7(June 1962).

Sodium iodide activated with thallium was used as the detector in a scintillation counter. The scintillating crystals were stressed with the intention of introducing dislocations and observing whether or not there was any measurable effect on the scintillation energy resolution intrinsic to the crystal. The photopeak was fitted to a gaussian curve to determine accurately the full width at half maximum. The results suggest that dislocations have a significant and detectable effect on the resolution. (auth)

23883 SCINTILLATION RESPONSE OF ALKALI IODIDES TO ALPHA PARTICLES AND PROTONS. J. W. Blue and D. C. Liu (National Aeronautics and Space Administration, Cleveland). IRE Trans. on Nuclear Sci. NS-9, No. 3, 48-51(June 1962).

The relative pulse height for all alkali iodide crystals, with and without activation, in response to alpha particles and protons was measured as a function of the incident particles energy at both liquid nitrogen and room temperatures. In all cases, the response curve is linear for protons of an energy range from 1 to 10 Mev, linear for alpha particles of high energies, but clearly nonlinear generally below 15 Mev. The response curve of activated crystals at liquid nitrogen temperature is generally flatter than that at room temperature. Unactivated crystals have a unique response only at liquid nitrogen temperature. For all crystals, the proton scintillation efficiency curve lies slightly below the linear portion of the alpha particles curve. A sharp change in dL/dE is observed in the region of $130 < dE/dx < 160$ kev/mg-cm^{-2}, indicating a threshold for a process which has a decreased probability of exciting luminescence. (auth)

23884 COMPUTATION OF EFFICIENCIES OF ORGANIC LIQUID SCINTILLATORS. Adam Heller (Israel Atomic Energy Commission Labs., Rehovoth). IRE Trans. on Nuclear Sci. NS-9, No. 3, 52-3(June 1962).

The results of the computation of the scintillation and fluorescence properties of 22 aromatic conjugated systems are presented. Some of these are expected to have superior properties to those in use at present. A new scintillation solute, 1,4-bis-(p-isopropylstyryl)-benzene, when used as a secondary solute in a p-terphenyl solution in xylene, has an efficiency higher than 80% on the anthracene scale. (auth)

23885 PROGRESS ON PHOTOMULTIPLIER TUBES AND IMAGE INTENSIFIERS AT EMI ELECTRONICS LTD. J. Sharpe (EMI Electronics Ltd., Hayes, Middx., Eng.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 54-61(June 1962).

The development of photomultiplier tubes for tube counting is discussed, and bias curves are given. The advantages of tubes with multi-alkali cathodes are described. Specific tubes are described, such as those developed for scintillation counting (venetian blind type), for use under vibration conditions, and for detection of ions and soft x rays. A 4-stage magnetically focused intensifier using bi-alkali cathodes is described briefly. (D.L.C.)

23886 PROGRESS IN PHOTOMULTIPLIER TUBES FOR SCINTILLATION COUNTING AND NUCLEAR PHYSICS. G. Pietri (Laboratoires d'Electronique et de Physique, Paris). IRE Trans. on Nuclear Sci. NS-9, No. 3, 62-71(June 1962).

The development of high speed photomultiplier tubes designed for nuclear physics research applications is described. The significant characteristics and parameters influencing the performance of high speed tubes are discussed with particular emphasis to rise time, transit time fluctuations, high gain, and linearity throughout a wide range of anode currents. The performance of the well-known types 56AVP and 58AVP are described and in addition, a new tube type XP1020 which provides many outstanding features with regard to high speed performance. Finally, standard types for gamma ray spectrometry, low energy beta particle, and soft x-ray detection are briefly discussed. (auth)

23887 SOME RECENT DEVELOPMENTS IN PHOTOMULTIPLIERS FOR SCINTILLATION COUNTING. R. M. Matheson (Radio Corp. of America, Lancaster, Penna.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 73-82(June 1962).

A family of three photomultipliers designed for good pulse height resolution was developed. Photomultipliers for scintillation counting under severe environmental conditions have been produced and additional types are under development. The introduction of new window materials and sealing techniques has led to tubes sensitive in the far ultraviolet. Several types giving improved high speed performance are under development. (auth)

23888 NEW DEVELOPMENTS IN PHOTOEMISSIVE TUBES. Frederick W. Schenkel (CBS Labs., Stamford, Conn.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 83-9(June 1962).

A discussion on a variety of special types of photomultipliers is presented. Among these are the CBS type CL-1090, 14-stage, high speed, low dark current type and the 5-inch ruggedized photomultiplier. Also presented are new developments in special type dynode multipliers and large area, high current photomultipliers. Recent developments in vacuum type neutron detectors are discussed briefly. (auth)

23889 FIELD-ENHANCED TRANSMISSION SECONDARY EMISSION FOR HIGH-SPEED COUNTING. E. J. Sternglass and G. W. Goetze (Westinghouse Research Labs., Pittsburgh). IRE Trans. on Nuclear Sci. NS-9, No. 3, 97-102(June 1962).

The time-response of high-gain transmission-type dynodes using KCl in the form of a low density layer is investigated. Both the results having light pulses and charged particles directly incident on these dynodes indicate no detectable time lag within the limits of the experimental method ($< 0.5 \times 10^{-9}$ sec). The number of emitted secondaries under the impact of α particles and electrons confirms the theoretical expectation that the yield is proportional to the rate of energy loss per unit distance, dE/dx. The results indicate that transmissive dynodes of the low density type with yields between 50 to 100 secondaries per incident 5 kev electron can be used both for high-speed electron multiplication and direct detection of nuclear particles without the use of scintillators. (auth)

23890 ELECTRON MULTIPLIERS UTILIZING CONTINUOUS STRIP SURFACES. W. C. Wiley and C. F. Hendee (Bendix Research Labs., Southfield, Mich.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 103-6(June 1962).

Thin films of semiconducting materials with secondary electron emission ratios greater than one have been used for some years in the Bendix crossed electric and magnetic field electron multiplier for ion detection. In these devices, the electric field to accelerate the electrons is established by the potential gradient created by external current flowing through the resistive strip. A low background counting rate, insensitivity to radiation in the visible and near ultraviolet, and stability on exposure to atmospheric gases are properties which permit this device to have interesting photon detection applications in the extreme ultraviolet in dynamic vacuum systems and outer space environment. A new form of electron multiplier utilizing continuous thin film surfaces, but not requiring a magnetic field, was developed. Small diameter tubes (a few mils I.D.) coated on the inside surface give gains up to 10^6. This "channel" multiplier has been operated singly as a miniature electron or photon detector, and in arrays im image intensifiers. The principle of operation and some applications of these channel amplifiers are discussed. (auth)

23891 THE FURTHER DEVELOPMENT OF A TRANSMISSION TYPE INTENSIFIER BY 20TH CENTURY ELECTRONICS LTD. D. L. Emberson (20th Century Electronics Ltd., New Addington, Surrey, Eng.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 107-14(June 1962).

A large number of transmission secondary emission image intensifiers to the basic design, described by Willcock et al., have now been constructed and the performance data obtained from these tubes is summarized. Based on this information, a tube of improved performance was designed incorporating a larger dynode area and most recently a multi-alkali photocathode. The preliminary performance data on a number of these tubes with respect to resolution and dark current are reported. The results of measurements of the operational fatigue of this type of tube are also described. (auth)

23892 TRANSMISSION SECONDARY EMISSION IMAGE INTENSIFIERS. N. A. Slark and A. J. Woolgar (English Electric Valve Co., Chelmsford, Essex, Eng.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 115-17(June 1962).

A brief discussion is given of the design and performance of a transmission secondary emission tube using a tri-alkali photocathode. Electron gain and photon gain vs applied voltage curves are given. (D.L.C.)

23893 PHOTOMULTIPLIER SINGLE-ELECTRON STATISTICS. Robert F. Tusting, Quentin A. Kerns, and Harold K. Knudsen (Univ. of California, Berkeley). IRE Trans. on Nuclear Sci. NS-9, No. 3, 118-23(June 1962). (UCRL-9986)

Measurements of the amplitude distribution of photomultiplier anode pulses due to the emission of single electrons from the cathode consistently show a peak. It is significant that the peak position agrees with that of a calculated distribution based on a Poisson distribution of secondary electrons at each dynode. The integral distribution, obtained by counting single-electron pulses, tends to show a plateau. In low-light-level counting applications, one can set the discriminator so that a majority of photomultiplier single-electron pulses will be counted. Further increase in the sensitivity will eventually increase the noise rate faster than the counting efficiency. The techniques for measuring photomultiplier single-electron statistics are useful for obtaining comparative collection efficiencies. By single-electron measurements, one can adjust focusing-electrode potentials to maximize over-all collection efficiency. It is believed that there is some correlation between the amplitude and time distributions. Further work is necessary to show the extent of the correlation. (auth)

23894 THE "STATE-OF-ART" IN NUCLEAR PARTICLE DETECTORS. James W. Mayer (Hughes Research Labs., Malibu, Calif.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 124-34(June 1962).

Some of the recent results obtained with conventional p-n and surface-barrier detectors and the performance of ion-drifted p-i-n and high-resistivity gallium-arsenide and silicon "conductivity" detectors are discussed. The operation of conventional devices in regard to resolution and stability measurements, the existence of a fission fragment energy defect, irradiation effects, and base resistivity variations are discussed. The response, resolution, and rise time of p-i-n detectors (depletion widths from 1 to 5 mm) are presented along with some of the factors influencing the characteristics of the ion-drift process. Work with high-resistitivy gallium-arsenide and silicon detectors has shown the influence of recombination processes. The limi-

tations and further improvements in these devices are indicated. (auth)

23895 NUCLEAR EXPERIMENTATION WITH SEMICONDUCTOR DETECTORS. D. A. Bromley (Yale Univ., New Haven). IRE Trans. on Nuclear Sci. NS-9, No. 3, 135-54(June 1962).

Significant progress has been made during the past year toward realizing the very great potential of semiconductor detectors in nuclear research; this progress is reviewed, together with brief reference to relevant earlier work. Representative fields where major advances have been recorded are those of electron and high energy heavier charged particle detection using lithium-drifted and other thick depletion layer devices, neutron detection studies, nuclear astrophysical research where the low mass, size, and power requirements are of paramount importance, focal plane studies with magnetic spectrographs involving multi-channel semiconductor systems, nuclear reaction product isotope identification with both hybrid gas and semiconductor detectors and with all semiconductor systems, high efficiency particle detection with large area mosaic detectors, and fission and other studies in high ambient neutral radiation fields where the junctions have unique advantages. Further applications are suggested. (auth)

23896 PROPERTIES OF AN n^+ i p^+ SEMICONDUCTOR DETECTOR. F. P. Ziemba, G. Pelt, G. Ryan, L. Wang, and R. Alexander (Solid State Radiations, Inc., Los Angeles). IRE Trans. on Nuclear Sci. NS-9, No. 3, 155-9 (June 1962).

A semiconductor nuclear particle detector fabricated by alloying or diffusing p^+ layers and n^+ layers into opposite faces of a slab of very high resistivity p-type silicon results in a device with several advantages over the conventional semiconductor detector structure. In the n^+ i p^+ structure, the space charge region extends throughout the entire silicon wafer upon application of a few volts bias and since further increases in bias do not appreciably change the width of the space charge region, the capacitance approaches a constant value. The series resistance of such a structure is very low and the collection time is exceedingly short, limited only by the applied field and the high field mobility of the carriers. Experimental data on collection time versus applied bias for several different nuclear particles as well as the characteristics of the unit in a low noise detector-amplifier system are presented. (auth)

23897 THE WINDOW THICKNESS OF DIFFUSED JUNCTION DETECTORS. R. L. Williams and P. P. Webb (RCA Victor Research Labs., Montreal). IRE Trans. on Nuclear Sci. NS-9, No. 3, 160-6(June 1962).

The detector window thicknesses for carrier gas diffusions were found to be very close to ½ the diffusion depths. This result is interpreted in terms of the concentration profile of the diffusant. In the surface region, where the impurity concentration is greater than 10^{18} per cc, the carrier lifetime becomes so small that ionized charges recombine before they can diffuse to the junction. With reduced surface concentrations, window thicknesses of less than ½ the diffusion depth were fabricated, but good voltage rating diodes with a window thickness of less than 0.1 micron (0.025 mg/cm^2) are yet to be realized. For all diffusion depths, a non-noise resolution limit of devices was observed which corresponds to approximately ⅓ the energy loss of an incident particle in the window layer of diodes. For paint-on diffusion detectors, the nominal 900°C–10 minutes–0.1 microns diffusion units have measured window thicknesses of about 0.3 microns. For the process studied it appears that an excessive amount of phosphorus is incorporated into the surface layer. (auth)

23898 CONSIDERATIONS IN THE DEVELOPMENT AND USE OF VERY THIN DIFFUSED-JUNCTION COUNTERS SUITABLE FOR $\Delta E/\Delta x$ DETECTION. C. N. Inskeep (Sarkes Tarzian, Inc., Bloomington, Ind.), W. W. Eidson, and R. A. LaSalle. IRE Trans. on Nuclear Sci. NS-9, No. 3, 167-73(June 1962).

Thin diffused-junction counters were developed suitable for use as $\Delta E/\Delta x$ detectors. Counters ranging in thickness from 0.0005 inch to 0.0025 inch and in area up to 1.0 inch diameter were fabricated by a process allowing a variety of counter shapes as well as good dimensional control. Tests with the 22-Mev alpha beam of the Indiana University cyclotron indicate satisfactory $\Delta E/\Delta x$ detection over a range of alpha particle energies from 22 Mev to below 7 Mev. Fabrication techniques are discussed. Some results are presented to illustrate the application of these $\Delta E/\Delta x$ detectors to nuclear spectroscopy. (auth)

23899 SEMICONDUCTOR FAST NEUTRON DETECTORS. G. Dearnaley, A. T. G. Ferguson, and G. C. Morrison (Atomic Energy Research Establishment, Harwell, Berks, Eng.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 174-80(June 1962). (AERE-R-3874)

The application of semiconductor junction detectors to spectroscopy and flux monitoring for fast neutrons is discussed in terms of energy resolution and efficiency. The most useful forms of counter appear to be proton-recoil and He^3-filled detector arrangements, and the construction, performance, and applications of such devices are described. A He^3 filled detector has given an energy resolution of 150 kev for neutrons of 2 to 4 Mev with an efficiency approaching 10^{-4}. Measurements are being made of the cross sections for reactions induced in the silicon of the detectors by fast neutrons, an effect which limits the range of neutron energies for which the counters can be used. Radiation damage to detectors is briefly discussed. (auth)

23900 IMPROVED TECHNIQUES FOR MAKING P^+-I-N^+ DIODE DETECTORS. J. L. Blankenship and C. J. Borkowski (Oak Ridge National Lab., Tenn.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 181-9(June 1962).

Techniques for achieving a thin dead layer exhibiting low sheet resistance on the n^+ side of a p^+-i-n^+ diode made by the lithium drift process were developed. A controlled quantity of lithium was diffused through a 1- to 2-micron phosphorus-doped layer on the silicon diode. The phosphorus-doped layer provided low sheet resistance. Because most of the lithium-diffused layer was drifted into the bulk material, dead layers of less than 7 microns thickness were achieved. Detectors made by this technique have given 23 kev (fwhm) resolution for gamma rays and monoenergetic electrons at room temperature, limited by diode noise. Detectors cooled to 78 to 195°K gave 6.5 kev resolution for Cs^{137} conversion electrons (625, 655 kev) and Pb^{207} x rays (74, 90 kev). Detectors stored without bias voltage at room temperature did not change performance over a four-month period. An analysis of the drift parameters show that the lithium drift rate depended upon the power dissipated in the diode during drift. An automatic control system was developed which allows the lithium drift operation to proceed at power dissipations in excess of 50 watts. (auth)

23901 PULSE SHAPE DISCRIMINATION IN P-N JUNCTION DETECTORS. Herbert O. Funsten (Princeton Univ., N. J.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 190-9 (June 1962). (PUC-1962-69)

A pulse shape discrimination circuit for solid state

particle detectors was developed that will distinguish between ionizing particles stopping completely within the junction region and those passing beyond. It is based upon the fact that the first kind of particles produce a fast rising pulse in the order of nanoseconds whereas the second kind have an added diffusion component in the microsecond region. A circuit description and representative spectra are given. (auth)

23902 THE OPERATION OF SOLID-STATE ALPHA COUNTERS IN CHEMICAL PROCESS STREAMS. L. Cathey and W. J. Jenkins (E. I. du Pont de Nemours Co., Aiken, S. C.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 193-9 (June 1962).

The alpha activity in a chemical process stream may be monitored by placing an etched N-type silicon wafer in the stream to operate as a surface barrier alpha counter. The counters are constructed by the Blankenship technique with the gold cover omitted. The bare silicon surface is immersed in the sample stream. Since the liquid of the stream forms the front contact to the silicon, the stream conductivity must be high. The detectors were operated in solutions of the nitrate salts of thorium, uranium, neptunium, plutonium, and americium. The effect of solution conductivity and acidity was investigated. The effects of aluminum and fluoride ions were studied also. The detector will cease to operate if the oxidation of the silicon surface is allowed to run to completion. The silicon dioxide layer will insulate the "P" inversion layer on the surface of the silicon from the liquid contact. If the bias is operated in the forward direction for short periods, the silicon dioxide insulator will be punctured and contact between the liquid and "P" inversion layer will be restored. A similar result can be achieved by illuminating the silicon surface for short periods to induce a photo-etch process. Both of these methods were used to maintain detectors in a counting condition for periods of up to nine months. (auth)

23903 B^{10} DIFFUSED JUNCTIONS IN N-TYPE SILICON. H. M. Mann and F. J. Janarek (Argonne National Lab., Ill.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 200-6 (June 1962). (UAC-6130)

Silicon diffused-junction detectors were prepared by diffusion of boron-10 into n-type silicon of resistivity 1000 to 3800 ohm-cm at a temperature of 1000°C. Detector diameters ranged from 3 mm to 2 cm. With the junction edge exposed in air or in vacuum, these detectors were extremely unstable. The use of organic silanes and ordinary waxes as a coating on the exposed junction edge provided stability. For some detectors, the treatment with silanes was followed by a decrease in leakage current during subsequent storage. For alpha particles, a resolution width of 40 to 45 kev was obtained for 6 Mev alpha particles in a detector of diameter 3 to 4 mm. For 2-cm-diameter detectors, the resolution width at this energy was 80 to 100 kev, but was reduced to 40 kev for alpha particles at a higher energy of 9 Mev. The peak-to-valley ratio for fission fragments from Cf^{252} was constant and equal to 1.40 at a detector reverse voltage of 15 volts or higher. The use of boron-10 allows identification of the energies of the products of fission reactions that occur within the detector, although similar detectors may be prepared using ordinary boron. For the present detectors the energies of the reaction products from the reaction $n(B^{10},Li^{7})\alpha$ and their sum were resolved with a resolution width of approximately 250 kev, and with energy corresponding to the known energies to within 5%. (auth)

23904 RESPONSE OF SILICON SURFACE BARRIER DETECTORS TO HYDROGEN IONS OF ENERGIES 25 TO 250 kev. R. I. Ewing (Sandia Lab., Albuquerque, N. Mex.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 207-10(June 1962). (SCDC-2522)

Commercially produced silicon surface barrier counters were exposed at room temperature to hydrogen ion beams varying in energy from 18 to 225 kev and the pulse spectra analyzed. The output was found to be linear with ion energy. A dead layer equivalent to about 4 kev loss by a 100 kev proton is indicated, suggesting that the gold surface layer is the only dead region. The width of the pulse spectrum is found to be about 9 kev for protons independent of ion energy and limited by system noise. Multi-atomic ions produce an output a few percent below that expected of an equivalent number of protons of the same velocity. The width of the pulse spectrum is also found to be greater for the multi-atomic ions than for protons. (auth)

23905 GOLD-DOPED SILICON DETECTORS FOR THE CONTROL OF BUBBLE CHAMBER PHOTOGRAPHY. C. R. Sun (Princeton Univ., N. J.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 211-12(June 1962). (PPAD-437E)

The properties of a gold-doped silicon detector were studied with β ray sources. The observed peak of 0.6 Mev from a $Sr^{90}-Y^{90}$ source agrees well with the most probable energy loss in the detector, calculated for minimum ionizing electrons. The ultimate aim is to use a matrix of 20 × 34 of such detectors to control bubble chamber photography. (auth)

23906 SOME MEASUREMENTS OF THE EFFICIENCY FOR OBSERVING PHOTOELECTRONS IN IMAGE INTENSIFIERS. J. R. Waters, G. T. Reynolds, D. B. Scarl, and R. A. Zdanis (Princeton Univ., N. J.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 239-42(June 1962).

A method is described for measuring the efficiency with which photoelectrons can be detected in an image intensifier system. A weak light is shone onto the first cathode and the photoelectron current measured. The light is then attenuated by a large known factor and compared with the number of spots observed in a given time. A simple system was used to demonstrate this method; a maximum efficiency of 85% was achieved. The results of experiments with a filament scintillation chamber and a Čerenkov detector using image intensifiers are discussed and yield some information about the electron detection efficiency. A simple method of finding the detection threshold is also mentioned with two typical examples of its results. (auth)

23907 SPARK CHAMBERS—STATE OF THE ART. James W. Cronin (Princeton Univ., N. J.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 247-55(June 1962).

A review of the present state of spark chamber technology is presented. The properties of spark chambers are reviewed and a summary of recent developments is given. An effort is made to make the survey of recent developments as complete as possible. Emphasis is given to technical problems which remain to be solved. (auth)

23908 IONIZATION DENSITY EFFECTS IN SPARK CHAMBERS. E. Engels, D. Roth, J. Cronin, and M. Pyka (Princeton Univ., N. J.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 256-8(June 1962).

During the course of an experiment on the decay properties of Λ^{0} particles, an ionization effect was observed qualitatively. The sparks of the heavily ionizing proton were bright and had 100% gap efficiency. The sparks of the minimum ionizing pion are weak and have a low gap efficiency. These observations are studied quantitatively. (auth)

23909 SPARK CHAMBER FOR ELECTRONIC DATA RETRIEVAL. Michael J. Neumann and Herrick Sherrard

(Univ. of Chicago). IRE Trans. on Nuclear Sci. NS-9, No. 3, 259-60(June 1962).

In preparation of an information retrieval system for experiments in nuclear physics, a digitized spark chamber was constructed and operated. Magnetic tape was used for direct recording. It is planned to provide a high speed buffer storage. (auth)

23910 REDUCTION OF DELAY BETWEEN PARTICLE PASSAGE AND SPARK CHAMBER SPARK. Joachim Fischer and Gus T. Zorn (Brookhaven National Lab., Upton, N. Y.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 261-74 (June 1962). (BNL-6101)

The delay time between the passage of an ionizing particle and the spark-chamber spark is one of the limiting factors in the time resolution of spark-chamber systems. The usual resolving time is of the order of 0.5 μsec. The delay time in photomultipliers, cables, coincidence mixers, high voltage pulse generators, spark gaps, spark chamber voltage rise, and spark formation is investigated. Elements of a system are described which result in a total delay of about 33 nsec, including the photomultiplier. This may permit a reduction in spark chamber memory time and time resolution by about one order of magnitude. The reduction in delays and rise times also decreases the displacement of tracks in spark chambers operating in a magnetic field. (auth)

23911 RECENT DEVELOPMENTS IN MULTICHANNEL PULSE-HEIGHT ANALYSIS. R. L. Chase (Brookhaven National Lab., Upton, N. Y.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 275-9(June 1962). (BNL-5993)

The state of the pulse-height analyzing art is reviewed with particular emphasis on the developments of the past two years. The discussion includes consideration of multidimensional instruments, calibration-stabilizing techniques, and some of the auxiliary features that are becoming increasingly available on commercial instruments. Possible future developments with respect to resolving time and memory organization is discussed briefly. (auth)

23912 SURVEY OF NANOSECOND TECHNIQUES. Albert L. Whetstone (Univ. of Pennsylvania, Philadelphia). IRE Trans. on Nuclear Sci. NS-9, No. 3, 280-4(June 1962).

In their application to high energy physics, nanosecond electronic techniques offer the experimenter the possibility of accumulating large amounts of highly selected data in the presence of intense backgrounds of uninteresting events. Selected examples of recent contributions to nanosecond electronics are reviewed. Attention is given to fast logic circuits, pulse measuring, and transmission techniques, and to the new components which have made the circuit developments possible. A temerous look at some future prospects is attempted. (auth)

23913 PULSE SHAPE DISCRIMINATION—A SURVEY OF CURRENT TECHNIQUES. R. B. Owen (Atomic Energy Research Establishment, Berks, Harwell, Eng.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 285-93(June 1962).

A feature of scintillation counters is their ability to provide information on the type of exciting particle from the characteristics of the scintillation decay. The current state of knowledge on the decay of organic and inorganic phosphors is reviewed, and the main features of the many circuits devised to utilize the effect are discussed. Limitations to the discrimination technique may be expected at high rates due to pulse pile up. The degrees of discrimination possible to low particle energies appears to be worse than may be expected on the basis of the photoelectron information available. The implications of this are examined. (auth)

23914 RECENT DEVELOPMENTS IN SCINTILLATION SPECTROMETRY. R. L. Heath (Phillips Petroleum Co., Idaho Falls, Idaho). IRE Trans. on Nuclear Sci. NS-9, No. 3, 294-304(June 1962).

The most important area of development in gamma-ray scintillation spectrometry at the present time is the adaptation of digital computer techniques to the analysis of pulse-height spectra. The use of multi-dimensional pulse analyzers capable of storing 256 spectra, each containing up to 256 channels of digital information, has greatly increased the need for automated data processing techniques. As a first step, logical adders and tape input-output systems have been added to modern analyzers to permit some reduction of data within the machine itself. The development of analytical techniques adaptable to machine programming, however, appears to represent the only reasonable solution of the problem. A series of computer programs are described which have been successfully applied to the reduction of pulse-height data using digital computers. The calculations carried out by these programs include: determination of pulse-height vs energy response of a NaI detector; calculation of coincidence sum spectra; and the analysis of complex pulse-height spectra to obtain energies and relative intensities of individual gamma rays or relative abundances from a mixture of radionuclides. Measurement problems and instrumental requirements are discussed in detail. (auth)

23915 TIME RESOLUTION OF A SCINTILLATION COUNTER SYSTEM. Arthur E. Bjerke, Quentin A. Kerns, and Thomas A. Nunamaker (Univ. of California, Berkeley). IRE Trans. on Nuclear Sci. NS-9, No. 3, 314-19(June 1962). (UCRL-9976)

Time resolution of a scintillation counter system composed of scintillator, light pipe, multiplier phototube, discriminator, and coincidence circuit is discussed. The discriminator and coincidence circuits can produce coincidence curves with edges as steep as 10 psec per decade. Multiplier phototubes are capable of similar resolution, providing they view sufficiently bright, well-defined light flashes. In a time-of-flight measurement at the Berkeley 184-inch Cyclotron, the coincidence curve slope, measured from a counting rate of 50% to 5%, is 400 psec per decade. The light level corresponds to 2000 electrons reaching the first dynode of the multiplier phototube. A slope of 200 psec per decade would be expected if only the multiplier phototube and electronics were considered. Geometry and rate of light output of the scintillator are believed to limit system resolution at present. (auth)

23916 REJECTION OF GAMMA BACKGROUND RADIATION PULSES IN HORNYAK BUTTONS. A. De Volpi and K. G. Porges (Argonne National Lab., Ill.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 320-6(June 1962). (UAC-6092)

The nature of pulses resulting from alpha, beta, gamma, and neutron irradiation of Hornyak buttons was examined under various conditions, including the use of light filters and both fast and slow electronics. Tentative conclusions about the mechanism of their origin are reached. Pulses from Compton recoils originate in the matrix and light transmitting media of the Hornyak button and phototube. Such pulses are of short duration, being similar in shape to photomultiplier noise pulses, in contrast to the 70-nanosecond decay of the fastest component of ZnS(Ag) fluorescence. A relatively simple, passive anticoincidence network is described which allows fast cancellation of the gamma-induced short pulses while passing the zinc sulfide scintillation with adequate efficiency. Rise time of the pulses emerging from the background suppression circuit

is about 7 nsec. This network, in conjunction with a distributed amplifier, tunnel diode discriminator, and other fast electronic equipment is used to select fission neutrons in coincidence with fission events. (auth)

23917 FAST PULSE MULTIPLICATION BY LOGARITHMIC ATTENUATORS. C. H. Vincent and D. Kaine (United Kingdom Atomic Energy Authority, Aldermaston, Berks, Eng.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 327-32(June 1962).

When a thin (dE/dx) transmission counter is used in front of a thick (E) particle counter, so that the particle may be identified by the two signals obtained, a pulse voltage multiplier of moderate accuracy and input range, but high speed, is required to effect the identification. A simple circuit of a new type, requiring no special components, and referred to as a logarithmic attenuator, was developed for this purpose. With pulses of a microsecond or more in duration, it gives an immediate output for identification. (auth)

23918 THE APPLICATION OF AUTOMATIC TESTING TO COMPLEX NUCLEAR PHYSICS EXPERIMENTS. Frederick A. Kirsten (Univ. of California, Berkeley). IRE Trans. on Nuclear Sci. NS-9, No. 3, 333-9(June 1962). (UCRL-9982)

The complexity of the data-acquisition systems required for advanced nuclear physics experiments is increasing. The difficulties involved both in setting up these systems and in detecting failures or drifts in the associated electronic equipment increase rapidly with the complexity of the system. To alleviate these difficulties, some automatic test routines for checking a complete data-acquisition system from phototube to scaler or analyzer were developed. One technique involves the use of the nanosecond light pulsers described by Kerns. These are mounted so as to illuminate the scintillators. Relay matrices for routing the electrical triggers to the pulsers were developed. The routing is programmed to sequentially activate various combinations of light pulsers, thereby simulating the nuclear events under investigation, as well as accidental events. Control systems are provided to perform the programming, with either automatic or manually controlled sequencing. Methods of checking or recording the results of the test routine are discussed. Two applications of this technique to actual experiments are described. (auth)

23919 DESIGN OF A SCINTILLATION COUNTER K^+ DETECTOR FOR A BUBBLE CHAMBER. T. Bowen and R. F. Roth (Princeton Univ., N. J.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 340-4(June 1962).

A K^+ detector is being designed for the Princeton-Pennsylvania Accelerator Rapid Cycling 15" Hydrogen Bubble Chamber which will trigger the photography whenever a K^+ is produced in the chamber. For the reactions of interest within the energy range, the K^+'s produced in the chamber will come to rest in the magnet coils needed for the field in the chamber and in the absorbers which will be placed in the gap between the coils. Plastic scintillators will be sandwiched between coil pancakes and absorber layers, and viewed by 96 2-in. photomultiplier tubes. All delayed pulses due to K^+ decay secondaries triggering at least two layers with delays greater than 7 nsec., which corresponds to 20 per cent of all K^+'s produced, will be detected. The major design problems are connected with economical design of the magnet-scintillation counter system and detection of the pulses delayed only a few nanoseconds in the possible presence of sometimes larger "prompt" pulses in the same counters. (auth)

23920 LIQUID SCINTILLATION COUNTER DESIGN PARAMETERS. Richard B. Frank (Nuclear-Chicago Corp., Des Plaines, Ill.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 345-51(June 1962).

The development of a liquid scintillation counting system led to an evaluation of several multiplier phototube types, the comparison of a number of counting chamber surfaces, and an investigation of thermoelectric photocathode cooling. The results obtained, including the more important performance and electronic circuit characteristics of the system, are described. (auth)

23921 A NEARLY-FOUR-Pi LIQUID SCINTILLATION COUNTER FOR BURSTS OF FAST NEUTRONS. Robert J. Lanter and Daniel E. Bannerman (Los Alamos Scientific Lab., N. Mex.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 352-6(June 1962).

This liquid scintillation counter detects 14 Mev neutrons by both proton-recoil and neutron-proton capture processes. It is designed to measure fast neutrons which occur in a single burst of a few microseconds duration, a burst which may contain anywhere from 100 to 100,000 neutrons. The counter is 36 inches in diameter, 36 inches long, and has an axial access cylinder 12 inches in diameter. It contains 475 liters of triethylbenzene, 2.5 grams per liter of p-terphenyl, and 0.02 grams per liter of POPOP. Scintillations are detected by 20 Dumont Type 6364 multiplier phototubes. Four tubes are used as proton-recoil detectors and 16 are used as neutron-proton capture detectors. The counter was completed in January 1959 and has shown high reliability and only a relatively small change in sensitivity since it was first calibrated. (auth)

23922 NUCLEAR PARTICLE SPECTROMETERS FOR SATELLITES AND SPACE PROBES. E. L. Hubbard (Univ. of Chicago). IRE Trans. on Nuclear Sci. NS-9, No. 3, 357-65(June 1962).

A series of particle detectors have been used by the University of Chicago in the cosmic ray research program. The first of the series used a grouping of seven methane-argon semiproportional counters. Of the two balloon-borne spectrometers, one used a thin (0.358 gm/cm^2) and a thick (13.53 gm/cm^2) CsI(Tl) scintillator and the associated photomultiplier tubes, while the other used a thin CsI(Tl) (0.716 gm/cm^2) scintillator and a Čerenkov counter ($\frac{1}{2}$-in. thick lucite) with their associated photomultiplier tubes. The first of these spectrometers was used to obtain the cosmic ray spectrum over the charge range of $6 \leq Z \leq 26$ and the energy range of 50 to 500 Mev/nucleon, while the second spectrometer was used over the same charge range but the energy range was from 400 Mev/nucleon to 10 Bev/nucleon. The Mariner A spectrometer is similar in principle to the low energy balloon-borne spectrometer but it operated over a slightly different energy and charge range. The charge range was Li, Be, B, C, N, and O, while the energy range was from 44 to 112 Mev/nucleon for Li^7 and from 23.1 to 220 Mev/nucleon for O^{16}. The Mariner instrument uses a gold-silicon diode to provide $-(dE/dx)$ information and it uses a photodiode to detect light pulses from the thick CsI(Tl) scintillator. (auth)

23923 PRACTICAL ASPECTS OF A SCINTILLATION SPECTROMETER SYSTEM FOR USE AT HIGH ALTITUDES. John Gilroy (Argonne National Lab., Ill.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 366-9(June 1962). (UAC-6125)

A system designed for obtaining γ spectra from high altitudes, using a lightweight balloon-borne device transmitting pulse information to ground equipment employing a

standard multichannel analyzer is discussed. The sensing unit is a thallium-activated cesium iodide crystal, surrounded with pilot B scintillator for discrimination against charged particles, observed by a 6199 photomultiplier tube. Packaging arrangements to minimize temperature effects and prolong battery lifetime are described. The resolution and drift recorded during operation of the system compared favorably with those observed in the laboratory without telemetering. (auth)

23924 A DOUBLE GAMMA-RAY SPECTROMETER TO SEARCH FOR POSITRONS IN SPACE. T. L. Cline (Goddard Space Flight Center, Greenbelt, Md.), P. Serlemitsos, and E. W. Hones, Jr. IRE Trans. on Nuclear Sci. NS-9, No. 3, 370-5(June 1962).

The advantages of the scintillation technique allow the development of experiments which can be made to respond preferentially to chosen types of particles. One such series of experiments requires the development of detectors which will identify single positrons mixed in a relatively high flux of other radiations. Directional detectors of positrons of energy between a few ev and a few Mev were designed to search for admixtures of these particles in the cosmic radiation near the top of the atmosphere, in the electron population of the trapped radiation zone, and in the solar particle streams and plasma clouds in interplanetary space. These detectors, which are scheduled for flight on balloons, sounding rockets and the Eccentric Geophysical Observatory satellite, are described. The scintillation techniques involved are discussed, and the analog and digital data-recovery instrumentation for each experiment is also outlined. (auth)

23925 A SCINTILLATION COUNTER TELESCOPE FOR CHARGE AND MASS IDENTIFICATION OF PRIMARY COSMIC RAYS. D. A. Bryant, G. H. Ludwig, and F. B. McDonald (Goddard Space Flight Center, Greenbelt Md.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 376-80(June 1962).

A cosmic ray telescope was developed to study the charge and energy spectra of primary cosmic radiation. The telescope is a combination of scintillators giving both the energy of a charged particle and its rate of energy loss, (dE/dx). This technique has been used extensively in the field of medium-energy nuclear physics and for studying the charge spectra of light fission fragments. A prototype detector was flown in balloons for a series of cosmic ray measurements in July 1961. Excellent charge and energy resolutions were obtained for electrons, protons, and alpha particles late in the large cosmic ray event of July 1961. It is planned to fly a satellite version of the instrument on the first NASA Orbiting Geophysical Observatory. The data obtained from balloon flights and the proposed satellite instrumentation are reported. (auth)

23926 DETECTOR FOR LOW ENERGY GAMMA-RAY ASTRONOMY EXPERIMENT. K. J. Frost and E. D. Rothe (Goddard Space Flight Center, Greenbelt, Md.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 381-5(June 1962).

A detector developed specifically for rocket and satellite borne low energy gamma-ray astronomy experiments is described. The detector consists of a 2-in. long × 1-in. diameter CsI(Tl) crystal viewed by a single photomultiplier tube together with a 8.75-in. long × 5.75-in. diameter CsI(Tl) crystal viewed by four photomultiplier tubes. The small crystal is inserted into a well of the larger crystal, the output of the smaller crystal being run in anticoincidence with the large crystal. The output from the small crystal surviving the anticoincidence circuit is fed into a pulse height analyzer. This detector and its mode of operation provides a gamma-ray spectrometer which has angular collimation, low background sensitivity, suppression of the Compton continuum, and relatively high photopeak efficiency. Data on the photopeak efficiency, angular response, and suppression of the Compton continuum at various energies are presented. Reasons for using anticoincidence shielding rather than bulk shielding with lead to contend with background problems are discussed. (auth)

23927 USE OF SCINTILLATION COUNTERS FOR SPACE RADIATION MEASUREMENTS. R. V. Smith, J. B. Reagan, and R. A. Alber (Lockheed Missiles and Space Co., Palo Alto, Calif.). IRE Trans. on Nuclear Sci. NS-9, No. 3, 386-90(June 1962).

Scintillation detectors used in space applications must meet rigid criteria for high performance at reduced pressure and variable temperatures and must withstand extremes of shock and vibration. A large number of tubes were subjected to shock and vibration tests. Ruggedized tubes withstood the tests and showed little change in gain. Measured temperature coefficients of gain varied from −0.19 to −0.53%/°C, from 25 to 70°C and may be circuit compensated. Battery and inverter type high voltage supplies have shortcomings which were overcome in a high frequency voltage inverter circuit which supplies potential to each dynode directly. A preamplifier is described which has a voltage gain of one, a high input impedance and wide dynamic range such that further amplification is not required. The techniques described were tested in several space flights. (auth)

23928 APPLICATION OF NUCLEAR SEMICONDUCTOR DETECTORS FOR SPACE SPECTROMETRY. S. S. Friedland, F. P. Ziemba, R. M. Olson, and H. Delyser (Solid State Radiations, Inc., Los Angeles). IRE Trans. on Nuclear Sci. NS-9, No. 3, 391-9(June 1962).

The principles of operation of the semiconductor detector and its response to charged particles are described briefly. Several detector systems for use as proton and beta spectrometers are described in detail. (D.L.C.)

23929 HIGH ENERGY GAMMA RAY SATELLITE EXPERIMENT. C. P. Leavitt (Univ. of New Mexico, Albuquerque). IRE Trans. on Nuclear Sci. NS-9, No. 3, 400-4 (June 1962).

In order to locate possible discrete sources of high energy cosmic rays as well as to gain information related to cosmic ray origins, a detector of 100 to 1000 Mev gamma rays was constructed for inclusion in the NASA Orbiting Solar Observatory, Satellite S-17. Both direction and energy are determined by a Čerenkov coincidence arrangement together with a total absorption lead glass Čerenkov counter. Solid state pulsed light sources will be used to provide calibration during flight. (auth)

23930 LUNAR COMPOSITION BY SCINTILLATION SPECTROSCOPY. M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.), E. C. Anderson, A. E. Metzger, and R. L. Schuch. IRE Trans. on Nuclear Sci. NS-9, No. 3, 405-12 (June 1962).

Information on the composition of the moon and its past history is being sought through measurements of the spectrum of the gamma rays emerging from the lunar surface. The detector is a 3 × 3 in. CsI-plastic scintillator phoswich feeding a 32-channel analyzer weighing 5 pounds. Energy range is to 3 Mev: in-flight calibration is provided by a small Co^{57} and Hg^{203} source fixed to the detector. Energy resolution is 12 ± 2 per cent at 0.66 Mev. The spectrometer, and indeed the entire spacecraft, is biologically

sterile. The spectrometer aboard Ranger 3 (launched January 26, 1962; missed the moon by about 20,000 miles) transmitted back spectra currently being studied; Rangers 4 and 5 are repeats scheduled for later in 1962. (auth)

23931 A NEW TECHNIQUE FOR RECORDING HEAVY PRIMARY COSMIC RADIATION AND NUCLEAR PROCESSES IN SILVER CHLORIDE SINGLE CRYSTALS. Charles B. Childs (Goddard Space Flight Center, Greenbelt, Md.) and Lawrence Slifkin. IRE Trans. on Nuclear Sci. NS-9, No. 3, 413-14(June 1962).

A new technique for recording heavy primary cosmic radiation and nuclear processes was developed through decoration of dislocations formed by these processes in large silver chloride single crystals. The crystals are prepared and exposed to cosmic radiation during high altitude balloon flights. The crystals are then treated according to the Haynes-Shockley photoelectric technique which results in silver collecting at the dislocations and thereby decorates the dislocations at room temperature within two hours. Since silver chloride is transparent to visible light, the decorated dislocations are observable with an optical microscope at a magnification of about 150 to 200. A one-to-one correspondence was established between tracks in the crystals and those in photographic emulsions accompanying the crystals during balloon flights. Examples of heavy primary cosmic radiation and nuclear processes in crystals are shown. (auth)

23932 AN IONIZATION DETECTOR FOR GAS CHROMATOGRAPHY. H.-K. Bothe. Isotopentechnik, 1: 163-4 (May 1961).

The use of ionization detectors in gas chromatography is discussed in general terms. An instrument is described which, using Sr^{90} as β source, allows the detection of material in quantities of the magnitude of 10^{-12} g/ml. The use of argon as a carrier gas is mentioned. The entire process is described. (OID)

23933 AN INVESTIGATION ON HIGH FREQUENCY ION SOURCE EFFICIENCY. Muceyyet Kuecuek (Univ. of Istanbul). Istanbul Univ., Fen Fak. Mecmuasi, Seri C, 26: 181-212(July-Oct. 1961). (In English)

The effects of pressure, extraction voltage, oscillator power output, magnetic lens construction, and the dimensions of extraction canal, etc., upon the efficiency of a high-frequency ion source of the Thonemann type were investigated, and relations between ion current and these factors were drawn. Ion currents of 2 ma were obtained at an oscillator power of 100 w, 100 Mc and 10.20 μ Hg pressure. The gas consumption was 10.20 cm^3/hr and the extraction voltage was 5 to 6 kv. A circuit design was used which ensured a good adaptation of the oscillator to the source, and the efficiency under the oscillation conditions was increased. Simplicity of the construction and an easy montage, low gas consumption, large ion current, stability and long life of the source, and low high-frequency power consumption were accomplished. These may facilitate utilization of the h-f source in high-tension sets. (auth)

23934 SAMPLING AND TRACK MEASUREMENTS IN FAST NEUTRON SPECTROSCOPY USING EMULSION TECHNIQUES. Cemil Karadeniz (Univ. of Istanbul). Istanbul Univ., Fen Fak. Mecmuasi, Seri C, 26: 213-19(July-Oct. 1961). (In English)

Effects of sampling methods on statistics and energy resolution of neutron spectroscopy are investigated; the change of the mean of the first straight portions of recoil proton tracks up 4 Mev and their single Coulomb scattering angles are studied to compare the effects of the sampling methods. The effects of track measurement methods on line width and energy are investigated; there is no change in line width through the spectrum taking the straight distance between the ends of the track and measuring the tracks bump to bump and adding the straight portions to get the track lengths. An energy shift of about 25 kev toward the lower side is observed having a slight line-shape deformation. (auth)

23935 VERSATILE HIGH SPEED ROTATING MIRROR CAMERAS. A. Skinner (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Sci. Instr., 39: 336-43(July 1962).

A description is given of some high speed rotating mirror streak and framing cameras, together with a discussion of the fundamental limits of performance of such instruments. These cameras have been developed at the Atomic Weapons Research Establishment, Aldermaston, and are now in regular use in the study of high temperature plasmas and explosive phenomena. Versatility combined with maximum efficiency of performance have been the over-riding considerations in their design. Interchangeable optical systems have enabled framing rates of 8 million per second to be achieved with frame sizes of 8 mm at the top end of the scale, to framing rates of one million per second with 25½ mm frame size at the bottom end. The corresponding maximum numbers of exposures obtainable are 117 and 23. Streak writing speeds of up to 30 mm μsec^{-1} are available. Synchronization of the events to be photographed is necessary and is achieved with an integral photoelectric system. (auth)

23936 THE DESIGN AND CONSTRUCTION OF A ROTATING MIRROR SMEAR CAMERA FOR ARC DISCHARGE STUDIES. M. McChesney and M. Coltman (Associated Electrical Ind., Rugby, Warwicks, Eng.). J. Sci. Instr., 39: 344-8(July 1962).

The practical problems encountered in the design and construction of a rotating mirror camera for studying the growth and wriggling behavior of an unstable pinched arc discharge are discussed. Details are given of the optical calculations necessary to obtain a writing speed of 2 mm μsec^{-1} with a lens aperture of f/4.5 using a 65000 rev min^{-1}, 0.5 h.p. induction motor to drive the mirror. A new method is given for minimizing the effects of image defocusing caused by the rotation of a thick mirror. The mechanical construction of the camera casing, film carrier and film cassettes is described together with details of the manufacture, balancing and polishing of the mirror. (auth)

23937 LARGE AREA LIQUID SCINTILLATION AND ČERENKOV COUNTERS. J. C. Barton (Northern Polytechnic, London), C. F. Barnaby, B. M. Jasani, and C. W. Thompson. J. Sci. Instr., 39: 360-3(July 1962).

A counter of 1 m^2 area and 10 cm deep is described which uses medicinal paraffin as the scintillator solvent. Although only one-third as efficient as other liquid scintillators it is cheap and has a much higher flash point. Using two 5 in. photomultipliers the counter had a resolution of 62% for the cosmic ray peak. For comparison purposes a Cherenkov counter of similar area was studied. Using a wavelength shifter, which improved the performance by a factor of five, this counter has a comparable resolution but needs to be very much deeper than the scintillation counter. (auth)

23938 CALIBRATION CURVES FOR DENSITY-GRADIENT COLUMNS. D. W. Budworth (University of Leeds, Eng.). J. Sci. Instr., 39: 377-8(July 1962).

Theoretical calibration curves for density-gradient columns at various stages of their development are derived on the assumption that the behavior is controlled by a Fick's law diffusion. Curves are given for two sets of initial conditions, corresponding to those most commonly used in practice. (auth)

23939 THE PREPARATION OF THIN FILMS OF V.Y.N.S. RESIN FOR 4π BETA-COUNTING. J. K. Johannesson (Australian Atomic Energy Commission, Sutherland, Sydney). J. Sci. Instr., 39: 390(July 1962).

The use of "Vinylite," a polyvinyl chloroacetate copolymer, in preparing thin films for beta counting was studied. A 3% solution in ethylene dichloride is placed on mercury in a tray, allowed to dry trimmed with a scalpel and transferred to the mount. Densities of 1 to 50 $\mu g/cm^2$ may be obtained. (T.R.H.)

23940 A SIMPLE RADIO-CHROMATOGRAM SCANNER. D. J. McWeeny and H. S. Burton (Ministry of Agriculture, Fisheries, and Food, London). J. Sci. Instr., 39: 396(July 1962).

A sturdy, simple, and reliable radiochromatogram scanner is described. It is constructed from a Panax Universal Castle, a Panax 5054 rate meter, and a recording milliampmeter. The castle houses 2 thin end-windows, G-M tubes type GE-EHM-2 mounted one above the other, windows ¼ in. apart. The 1-in. chromatogram passes continuously thru a selection of slits permitting a choice of views by the G-M tubes. The background count is 10.5 counts per minute and the detection limit for S^{35} as a 3 mm spot on Whatman no. 1 paper is less than 0.2 μc. (T.R.H.)

23941 BASIC TYPES OF DIRECTION GAMMA DETECTORS AND THEIR USE IN MEDICINE. [PART] I. Štefan Ilipka. Jaderná energie, 8: 109-16(1962). (In Czech)

Descriptions and arrangements of basic types of directional gamma detectors are given along with their uses in medicine, namely in local diagnoses. (P.C.H.)

23942 SCINTILLATION DETECTORS AND THEIR APPLICATIONS. Josef Šilar. Nová tech., No. 2, 64-8(1960).

A general review on the application of scintillation detectors is given. A scintillation detector is described which is based on the suitable connection between the scintillator, multiplier, photocathode, amplifier, discriminator, and registration device. A significant increase in the detecting efficiency of γ radiation is the most important practical advantage of scintillation detectors, the efficiency being 30 to 60 times higher than for G-M counters. For detecting extremely low γ radiation, scintillation detectors with large NaI(Tl) crystals and equipped with a cylindrical opening were developed. A precise detection of γ rays with an activity of 10^{-10} c in 1-min measuring intervals is possible. Large-area scintillation detectors equipped with a ZnS layer activated by Ag are suitable for testing working places for α-ray contamination. Windowless scintillation detectors with a detecting efficiency of 50% are applied for detection and spectral analysis. Photomultiplier noise pulses, which deteriorate the performance of the device, can be eliminated by cooling the photocathode or by a coincidence arrangement. Thus an efficiency of approx. 70% can be obtained in detecting C^{14}, while the G-M counter had a much lower detection efficiency. (OID)

23943 NUCLEAR ELECTRONICS. MULTICHANNEL SELECTORS WITH MAGNETIC MEMORY. R. Wahl and J. M. Tissier. Nucleus (Paris), 1: 57-64(Jan.-Feb. 1962). (In French)

Multichannel selectors are evolving toward an increasing complexity, and they are finding uses outside the realm of nuclear physics. A brief description is given of the various types of selectors and their operation. Various specialized utilizations are tabulated. A memory block with 4,096 channels is discussed in some detail. (J.S.R.)

23944 THE DETECTION OF NUCLEAR RADIATION BY SEMICONDUCTORS. Lydie Koch. Onde élec., 40: 807-14(Nov. 1960).

The rapid progress made in solid state physics had made it possible to use semiconductors for a new class of radioactive detectors whose accuracy, sensitivity, simplicity, response time, and inexpensiveness compare favorably with conventional detectors. The detectors are based on the principle that if a charged particle traverses a semiconductor, it creates a number of electron-hole pairs. The mean energy of pair creation is 2.94 ev for Ge and 3.50 ev for Si. Electrons and holes have the tendency to recombine rapidly, but in an n-type crystal of great purity the life of the charge is longer and depends on the number of holes. It is of the magnitude 10^{-6} to 10^{-3} sec. If a Ge or Si junction is placed between electrodes, electrons and holes are rapidly separated by the electric field and collected at opposite parts of the junction. A potential difference appears and then disappears according to the law, $e^{-t/\theta}$, where $\theta = RC$ which is the product of junction resistance and capacity. The junction field lies between 10^3 and 10^4 v/cm and the response velocity at 5×10^6 cm/sec, which means that charges are collected in less than 10^{-9} sec. The theoretical foundation of semiconductor detectors and their radiological characteristics are described. Their performance is illustrated with the spectrum of Th^{228} and its descendants and the fission spectrum of Cf^{252}. Finally, portable detectors for α, β, and γ radiation are described. (OID)

23945 COMPARISON OF DIFFERENT HIGH VOLTAGE DEVICES FOR THE OPERATION OF NUCLEAR EQUIPMENT. W. Richter. Radio u.Fernsehen, 9: 679-81(Nov. 1960).

For the operation of radiation measuring devices, such as Geiger or scintillation counters, higher voltage apparatus are needed which in general must be designed for voltages up to 2000 v and currents of a few milliamperes. Various basis circuits for the generation of high voltages are described, and their relative efficiencies are compared. Mention is made especially of the high voltage generators of Bernhard, Higinbotham, O'Toole, and Mackenzie. For various reasons the Mackenzie circuit is preferred. Recently, the use of transistors and finally full transistorization have attained great significance because they allow a great increase of efficiency, a lengthening of the operation life, and a decrease in both weight and volume of the apparatus. (OID)

23946 SCINTILLATION MEASURING EQUIPMENT. Gerhard Schubert, H. Dieter Hemple, and Gunter Roemer. Radio u. Fernsehen, 9: 751-9(Dec. 1960).

The SM59 measuring equipment for γ-spectroscopy developed in 1958 by the Zentralinstitut für Kernphysik, Dresden, is described. The instrument is illustrated and its characteristics are listed in a table. (OID)

23947 ELECTRON RESONANCE MAGNETOMETER FOR ALTERNATING MAGNETIC FIELDS. O. E. Spokas and M. Danos (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr., 33: 613-17(June 1962).

Alternating magnetic fields in the range of 2800 to 4300 gauss are measured in terms of the frequency of the free-electron spin resonance in 1:1-diphenyl-2-picryl hydrazyl.

The probe is constructed entirely of dielectric materials. An accuracy of 0.1% in the field determination was obtained. (auth)

23948 ROLLER X-RAY SPECTROMETER. Sema'an I. Salem (Long Beach State Coll., Calif.) and Neil G. Peake. Rev. Sci. Instr., 33: 617-18(June 1962).

A spectrometer that utilizes rollers rather than gears to perform the appropriate angular changes of its components was designed and put into operation. The precision ground rollers proved to be effective in reducing any backlash in the drive mechanism without introducing any noticeable skidding. A set of screws provides a simple and rapid way of securing the diffraction crystal in its proper place for continuous alignment. (auth)

23949 LIQUID METAL SOLUTION CALORIMETER. B. W. Howlett, J. S. Ll. Leach, L. B. Ticknor, and M. B. Bever (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr., 33: 619-24(June 1962).

A liquid metal solution calorimeter and its operation are described. The method of calculation is outlined and the sources of error are analyzed. In this calorimeter, heat effects upon dissolution of samples in liquid metals are measured; heats of solution are determined directly and heats of formation, energies of ordering, and the stored energy of cold work are found by a difference method. The calorimeter operates in the temperature range 240 to 450°C; samples are added from 0 or −195°C. Highest accuracy, of the order of ±2 cal/g-atom, is attained with suitable chosen solute-solvent combinations giving very small total heat effects upon dissolution. (auth)

23950 ULTRASONIC cw SPECTROMETER FOR THE INVESTIGATION OF ELECTRON SPIN-PHONON INTERACTIONS IN SOLIDS. D. I. Bolef, J. de Klerk, and R. B. Gosser (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr., 33: 631-8(June 1962).

A cw acoustic spectrometer operating in the frequency range of 10 to 1000 Mc is described. The acoustic probe, applicable to low temperature measurements, is characterized by its mechanical resonance properties. Several of the novel features of the spectrometer are described in some detail. The apparatus, essentially the acoustic analog of an electron paramagnetic resonance microwave transmission spectrometer, was applied to the study of electron spin-phonon interactions in solids. (auth)

23951 HIGH TEMPERATURE DROP CALORIMETER. Leonard S. Levinson (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr., 33: 639-45(June 1962).

A high temperature drop calorimeter to measure heat contents between 1000 and 2500°C was made. A graphite tube furnace and an adiabatic shielded receiver block are described. The receiver block was electrically calibrated and the calibration compared with the heat content of α-aluminum oxide. (auth)

23952 AUTOMATIC FREQUENCY CONTROL SYSTEM FOR A MICROWAVE LINEAR ELECTRON ACCELERATOR. C. J. Karzmark (Stanford Medical Center, Palo Alto, Calif.). Rev. Sci. Instr., 33: 645-8(June 1962).

In the operation of microwave electron linear accelerators, adjustment of the frequency-determining element of the power source is frequently required to optimize performance. These adjustments are necessitated by thermal-mechanical changes of the accelerator structure proper as well as independent changes of the oscillator frequency. An automatic frequency control system was designed to maximize the x-ray output for an S-band accelerator used in radiation therapy. Frequency modulation of the oscillator produces a phase sensitive amplitude modulation component in the x-ray output. This information is used with a suitable detector and servo system to effect frequency corrections. (auth)

23953 QUALITATIVE AND QUANTITATIVE GAMMA ANALYSES OF LOW ACTIVITIES BY THE GREY-WEDGE METHOD. Telefunken Ztg., 34: 249-56(Sept. 1961). (In German)

A pulse-height analyzer was developed which is used for the analysis of nuclear beam spectra and permits the identification of gamma-emitting isotopes. It operates either by the one-channel or the grey-wedge method. Commercial apparatuses for the very simple grey-wedge method are still not available. This method is as fast as the multi-channel methods, so that it is especially suited for measurements of isotopes with short half lives and for measurements of very weak activities. The results of measurements of very low activities using grey-wedge spectroscopy are reported. (tr-auth)

23954 HIGH-FREQUENCY MASS SPECTROMETER. H. J. Schuetze. Telefunken Ztg., 34: 257-64(Sept. 1961). (In German)

A high-frequency mass spectrometer which operates without a magnetic field is described. It fulfills the requirements of high resolutions and perturbation-free recording of the spectra in the pressure range from 10^{-6} to 10^{-3} torr. The construction, operation, and properties are shown graphically. (J.S.R.)

23955 TRANSISTORIZED RADIATION MONITORS. Taro Oba and Katsuyoshi Saito. Toshiba Rebiyu, 15: 715-18(June 1960).

New types of transistorized radiation monitors, which were reduced in size, weight, and power dissipation are discussed. The electronic circuits for these radiation monitors consist of transistorized plug-in type circuit elements designed to meet production requirements. The pulse amplifier, rate meter, pulse height analyzer, standard pulse generator, d-c high voltage power, and medium power and low voltage power sources are discussed. (CID)

23956 PARTICLE DISCRIMINATION WITH KI(Tl) SCINTILLATORS. R. Langkau, H. Neuert, and H. Walter (Institut für Experimental Physik, Hamburg). Z. Naturforsch., 17a: 441-3(May 1962). (In German)

It is shown that by means of suitable selection of the Tl concentrations and the crystal temperature, the particle discrimination characteristics of the KI(Tl) scintillator can be substantially improved. The increase of the Tl content to 1 mol % increased the light output. By raising the crystal temperature above room temperature by +20°C and more, the transient course of the scintillation was changed in a complex manner. Various examples of particle discrimination are shown using these improvements in the scintillator. (M.C.G.)

23957 ELEKTRONISCHE ZÄHLGERÄTE FÜR KERNSTRAHLUNG. (Electronic Counting Apparatus for Nuclear Radiation). Harry Muschter. Leipzig, Veb Deutscher Verlag für Grundstoffindustrie, 1960. 164p. 9.80 DM.

The wiring and electronic components of radiation counting apparatus are described. Topics covered include basic problems in nuclear physics measuring techniques, individuality of impulse-formed signals, basic electronic wiring used in counting apparatus, electronic impulse-counting wiring, basic wiring for pulse radiation detectors, the construction of counting apparatus for nuclear radiation, and uses of the counting apparatus. Detectors included are counting tubes, scintillation counters, and im-

pulse ionization chambers. Wiring diagrams are given. (M.C.G.)

23958 NOTES ON LOW LEVEL BETA COUNTING. 1961. 10p. Tracerlab, Inc., Waltham, Mass. $2.75 (Tracerlab, Inc.).

Techniques and standard equipment for low-level beta counting are discussed. Circumstances for using low-level beta counting equipment are described. Selection of the best counter, counting time required, limits of detection, sources of background, background reduction, anti-coincidence unit, counter materials, and efficiency are discussed. (M.C.G.)

23959 PRIBORY I METODY ANALIZA IZLUCHENII (SBORNIK NAUCHNYKH RABOT) BYP. 2. (Radiation Analysis Methods and Devices (Collection of Articles)). K. D. Stolyarov, ed.-in-chief. Moscow, Atomizdat, 1960. 196p.

Theoretical and experimental data on γ fields from extended sources (considering source geometry), self-absorption, and multiple Compton scattering are presented in 17 articles. Radioinduced heating of shielding by thermal neutrons, γ dosimetry up to 250 Mev, water-phantom dosimeters for measuring γ bremsstrahlung in betatrons and synchrotrons, and thick-wall ionization chambers for measuring bremsstrahlung from 35 to 300 Mev are discussed. Several articles deal with γ- and electron-emission spectra. Corrections are given for scintillation measuring methods, and an analysis is made of the effects of temperature on the amplification of photomultipliers. Descriptions are given of a flexible device for measuring delayed coincidences at 10^{-10} to 10^{-1} sec, and an expression was derived for a recoil nucleon polarization. Two articles deal with dispersion and the resolving power of magnetic analyzers. (R.V.J.)

23960 RADIATION DETECTORS. Richard Just and Adnan Waly (to Specialty Engineering and Electronics Co.). U. S. Patent 3,042,802. July 3, 1962.

An improved radio-photoluminescent dosimeter structure for x and gamma rays is designed which is stable in operation and has a constant pre-dose under all conditions. The dosimeter comprises a waterproof casing housing a silver-activated phosphate glass and free from adhesives or other fluorescent material. The square-shaped glass element has one side and one edge left uncoated, but the other side and edges are fritted with a black non-reflecting, non-fluorescing vitreous material. In operation, the dosimeter is exposed to the radiation and then to uv light to cause it to luminesce. The amount of luminescence is taken to be a measure of the radiation dose after correction for the pre-dose characteristic of the glass. (D.L.C.)

23961 METHOD OF AND APPARATUS FOR REDUCING REMNANT MAGNETIC FIELDS IN NUCLEAR MAGNETISM WELL LOGGING. Robert J. S. Brown (to California Research Corp.). U. S. Patent 3,042,855. July 3, 1962.

An improved spin magnetic induction well logging apparatus is designed which has a homogeneous precession field. The core of the apparatus is constructed out of non-magnetizable materials so that drilling fluid is excluded from the coil. (D.L.C.)

23962 NUCLEAR MAGNETIC RESONANCE DETECTORS. Edward Watson (to Fairey Aviation Ltd.). U. S. Patent 3,042,856. July 3, 1962.

Two nuclear magnetic resonance detector embodiments are described in which the nuclear resonance frequency is varied in relation to that of the high-frequency signal. An audio-frequency output is obtained whose amplitude gives a measure of the difference between the resonant frequency of the sample and the oscillator frequency. The advantage of the detectors is that the resonant condition does not persist long enough for the nuclei to become saturated. (D.L.C.)

Materials Testing

Refer also to abstract 24643.

23963 (ANL-6515) SECOND SYMPOSIUM ON PHYSICS AND NONDESTRUCTIVE TESTING, HELD AT ARGONNE NATIONAL LABORATORY OCTOBER 3-5, 1961. Roberta Ann di Novi, ed. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 262p.

Thirteen papers are included; separate abstracts have been prepared for each. Abstracts of two papers on some optical and electrical properties of materials and nondestructive testing of reactor irradiated metals are also included. These two abstracts are not included in NSA. (N.W.R.)

23964 (ANL-6515(p.9-27)) ACTIVATION ANALYSIS FOR MATERIALS TESTING AND RESEARCH. E. A. Burrill and J. Hirschfield (High Voltage Engineering Corp., Burlington, Mass.).

The uses of positive-ion accelerators and neutron sources for material evaluation and analysis are described in terms of basic experimental results obtained on a variety of problems. Surface and volume activation techniques are appraised from data as well as from theoretical considerations. Problems of neutron and radioactivity detection are discussed from the viewpoint of reduction to practice in the industrial laboratory. (auth)

23965 (ANL-6515(p.28-52)) NEUTRON RADIOGRAPHY: A SECOND PROGRESS REPORT. Harold Berger (Argonne National Lab., Ill.). (ANL-FGF-296)

The progress made on investigations of neutron radiography since October 1960 is discussed. The problems of the production of the neutron image will be discussed. The emphasis will be on the characteristics of many of the photographic imaging methods which can be used for neutron radiography. (auth)

23966 (ANL-6515(p.53-80)) INVESTIGATIONS IN NEUTRON IMAGING. H. V. Watts (Illinois Inst. of Tech., Chicago. Armour Research Foundation).

The effects of neutron scattering in a radiographic object and the effects of the characteristics (sensitivity and resolution) of a neutron imaging detector on the image quality are considered for various applications of neutron radiography. In the thermal neutron energy region, in which the greatest differences in neutron cross sections among various elements exist, scattering constitutes a major portion of the total cross section of most of the common elements. Thus, the scattering effect is important when one considers certain neutron radiography. Results of both neutron images and analogous optically synthesized images, using a spot diagram which is related to the neutron scattering, are shown and compared for various thicknesses of the neutron scatterer. An evaluation of proposed imaging-detector systems, with different sensitivities and resolutions, for specific requirements of neutron radiography was performed on an optical bench with the image-synthesis technique. Various neutron detectors which appear applicable for image work are discussed. (auth)

23967 (ANL-6515(p.81-6)) THE LATENT IMAGE. Albert H. Allard (Eastman Kodak Co., Rochester, N. Y.).

The formation and subsequent development of the latent image is discussed. It traces the roll of gelatin in emulsion making, the structure of the silver bromide crystal, formation of sensitivity centers, and the electrical conductivity of the crystal as well as its role in the sequence of events producing the latent image. The effect of the latent image in relation to chemical processing is also discussed. (auth)

23968 (ANL-6515(p.87-101)) THE MEANING OF CHARACTERISTIC CURVES. E. T. Larson and H. F. Nitka (Ansco Div., General Aniline and Film Corp., Binghamton, N. Y.).

The characteristic curve of an x-ray film can be used directly to predict the rendition of large-scale features in the subject. For small-scale features it is found that the statistical fluctuations in the exposing radiation may have a material effect on the rendition. The effects of the statistical fluctuations are computed from the characteristic curve and are found to agree with experimental observations on actual radiographs. (auth)

23969 (ANL-6515(p.102-16)) FACTORS AFFECTING RADIOGRAPHIC SENSITIVITY. William D. Kiehle (Eastman Kodak Co., Rochester, N. Y.).

The various factors affecting radiographic sensitivity, namely, radiographic contrast and definition are discussed and illustrated. Subject and film contrast and geometric and graininess factors are discussed with illustrations showing how radiographic sensitivity may be affected by changing each of these factors. (auth)

23970 (ANL-6515(p.117-20)) GENERATION AND DETECTION OF ULTRA-HIGH-FREQUENCY SOUND WAVES IN SOLIDS. H. E. Boemmel (Bell Telephone Labs., Inc., Whippany, N. J.).

Ultrasonic waves have proved to be a very powerful tool for the investigation of various problems in solid state physics, such as the interaction of the lattice with dislocations, and electron phonon interaction in metals. Recently, new methods were developed to make it possible to extend the frequency range up to microwave frequencies. At these frequencies the acoustic wavelength in solids is of the order of 10^{-4} to 10^{-5} cm, which allows the investigation of such phenomena and the interaction of the hypersonic wave with the thermal phonon with paramagnetic spin or thin wave phonon wave interaction in paramagnetic materials. A number of these problems as well as the experimental technique will be discussed. (auth)

23971 (ANL-6515(p.121-32)) ULTRASONIC PROPAGATION IN DEFORMED SINGLE AND POLYCRYSTALLINE MATERIALS. F. R. Rollins (Midwest Research Inst., Kansas City, Mo.) and R. R. Rowand (Aeronautical Systems Div., Wright-Patterson AFB, Ohio).

Stresses were applied to polycrystalline and single-crystal specimens to produce double refraction of megacycle shear waves. The manner in which the birefringent nature of the material varies in the elastic and plastic regions is described, and the stress-induced anisotropy which produces the effect is discussed. A pulse-echo technique for observing shear-wave double refraction is described, and sources of error are presented. (auth)

23972 (ANL-6515(p.133-61)) MECHANICAL VIBRATIONS IN SOLID RODS. Ronald G. Peterson (Argonne National Lab., Ill.).

The propagation of periodic mechanical vibrations, i.e., sound waves, in solid cylinders differs significantly from their propagation in extended solid bodies. If the radius of a solid rod approaches the wavelength of the sound in the rod, the rod must be considered as a waveguide, and the relationship between the elastic moduli of the solid and the velocities of sound propagation and attenuation will differ from these relationships in extended solid bodies. Since the rod is a common form of specimen used in studies of elastic moduli of solids, many investigations were made concerning the characteristics of sound in rods. These characteristics are reviewed for both continuous and pulse propagation, especially in the megacycle range of frequencies. Experimental applications of these studies are discussed. (auth)

23973 (ANL-6515(p.163-86)) INFRARED PHYSICS. H. L. Sachs (Perkin-Elmer Corp., Norwalk, Conn.).

Continuous, remote measurement of the radiant emission from heated surfaces offers the capability for detection of flaws or voids internal to a specimen. The buildup of surface temperature gradient and departure from norm in the vicinity of internal flaw regions are discussed with emphasis on laminated structures and defects in metal to thermal insulator bonds. The performance requirements for infrared instrumentation with measurement capabilities suited for this task are outlined and special attention given to practical aspects of the problem. An experimental technique and some recent promising results are presented. (auth)

23974 (ANL-6515(p.187-201)) THERMISTORS. Robert S. Goodyear (Fenwal Electronics, Inc., Framingham, Mass.).

A survey is given of the various types and sizes of thermistors currently available with information about their electrical and thermal characteristics, including resistance-temperature, voltage-current, and current-time characteristics, as well as stability, reproducibility, precision, and range of reliable operation. Applications will be mentioned to show how the different characteristics are used. (auth)

23975 (ANL-6515(p.203-17)) COLOR RADIOGRAPHY. Norman S. Beyer (Argonne National Lab., Ill.).

Some color radiographs and autoradiographs together with the technique used to produce them are presented and studied. An evaluation is made of both the practical and impractical aspects of the study. (auth)

23976 (ANL-6515(p.218-47)) SOME DESIGN ASPECTS OF LINEAR ACCELERATORS USED FOR HIGH ENERGY X-RAY PRODUCTION. J. Haimson (Varian Associates, Palo Alto, Calif.).

The theory of operation of the linear accelerator (linac) is described and is followed by a discussion of some fundamental design parameters and their relationship to electron and x-ray beam performance. By utilizing an electron beam bending system and rotating x-ray head, the x-ray beam may be directed at right angles to the accelerator waveguide and rotated through 360° in a vertical plane. This feature, which provides greater operational flexibility and extreme x-ray source stability, depends upon the achievement of a stable and sharp electron energy spectrum and a small beam cross section. These requirements are related to several aspects of linac electron beam optics and some examples are given. (auth)

23977 THE USE OF AGFA-TEXO-F-FILM IN THE NON-DESTRUCTIVE TESTING OF MATERIALS WITH γ-RAYS. E. Schiebold, E. Becker, and F. Vorsprach. Isotopentechnik, 1: 2-9(Aug. 1960).

A new fine grain film was developed by VEB Agfa, Wolfen, which shows a marked improvement in sensitivity and contrast for γ defectoscopy than other commercial X-ray and γ-ray films. Results are summarized of a sys-

tomatic investigation with Co^{60} and Ir^{192} on the influence of exposure duration and on the contrast and clarity of this film for various test materials. (OID)

23978 THE USE OF CARBON TETRACHLORIDE AS A RADIOPAQUE PENETRANT. K. Cotterell and R. S. Sharpe (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nondestructive Testing, 20: 234-7(July-Aug. 1962).

By introducing carbon tetrachloride as a radiopaque penetrant into surface cracks, radiographic sensitivity was considerably improved with materials of low x-ray absorption, such as beryllium, beryllia, and graphite. When applied to coarse-structured reactor graphite, cracks can be detected which are not resolvable by ordinary radiographic techniques. When used in conjunction with x-ray microscopy techniques, considerable additional information in microstructural defects and surface profiles can be obtained. (auth)

23979 NONDESTRUCTIVE TESTING OF HOT PRESSED BERYLLIUM FOR INERTIAL INSTRUMENT APPLICATIONS. L. L. Soffa (North American Aviation, Downey, Calif.). Nondestructive Testing, 20: 242-4(July-Aug. 1962).

Nondestructive testing methods for hot pressed Be are discussed. X-ray examination was found to be a very effective method for screening Be nondestructively for internal defects. Fluorescent penetrant testing serves as an excellent supplementary method to x-ray examination for testing the surface quality of Be after heat treatment, machining, and other fabrication processes. Electron probe microanalysis is effective in identifying inclusions and impurities. Under certain circumstances it is also nondestructive. X ray resulted in a better understanding of the physical behavior of the material. (P.C.H.)

23980 TECHNIQUES FOR LOW-VOLTAGE RADIOGRAPHY. R. W. McClung (Oak Ridge National Lab., Tenn.). Nondestructive Testing, 20: 248-53(July-Aug. 1962).

Developments in technique, which were performed to improve the radiographic quality for relatively thin sections of such materials as aluminum, stainless steel, and beryllium, are discussed. It is concluded that the applicable thickness ranges for 0 to 50 kvp energy and reasonable exposure times (less than 10 min) seem to be up to approximately 0.037 in. of stainless steel, 0.750 in. aluminum, and more than 2.0 in. of beryllium. Considerable advantage can be realized for both sensitivity and exposure times by the use of intermediate helium atmospheres and darkroom, bare-film exposure techniques. Exposure charts were constructed as aids to the attainment of optimum radiographs. (P.C.H.)

23981 A RADIOISOTOPE LABORATORY FOR BUILDING MATERIALS RESEARCH. Harry Cermak. Silikat Tech., 11: 577-9(Dec. 1960).

A description and many photographs are given of the recently completed Radioisotope Laboratory of the Inst. for Construction Materials in Weimar. The Laboratory consists of a "hot lab." for handling radioactive materials that may contain T, C^{14}, S^{35}, Ca^{45}, and Fe^{59}; a room for physicochemical research; a room for irradiation with a 1000 mc Co^{60} preparation; a measurement room containing all customary and also some very modern measuring apparatus; and a dark-room for photographic work. (OID)

GEOLOGY, MINERALOGY, AND METEOROLOGY

23982 (AERE-Bib-140) MEASUREMENT OF SOIL MOISTURE AND DENSITY BY NUCLEAR METHODS. A Bibliography. R. Sweeney (United Kingdom Atomic Energy Authority. Research Group. Wantage Research Lab., Wantage, Berks, England). May 1962. 15p.

This bibliography contains 87 references to information published between 1950 and mid-1961. Some relevant references to the measurement of moisture in materials other than soil are included. An author index is included. (N.W.R.)

23983 (CEX-59.4.11) AERORADIOACTIVITY SURVEY AND AREAL GEOLOGY OF THE HANFORD PLANT AREA, WASHINGTON AND OREGON (ARMS-I). Robert G. Schmidt (Geological Survey, Washington, D. C. and Division of Biology and Medicine, AEC). Mar. 1961. 25p.

An airborne gamma radioactivity survey of 9000 sq. miles in south-central Washington and north-central Oregon indicates a moderate range in the level of radioactivity and that the various levels are generally related to the geology of the region. Continuous radioactivity profiles were obtained with scintillation counting equipment at 500 ft above the ground on parallel north-south flight lines spaced 1 mile apart. Locally, the mountainous topography prevented operation of the aircraft on the planned flight lines, and in some of these areas a few substitute flights were possible along the valleys. A map of aeroradioactivity units was prepared from the profiles. Bedrock in the Hanford Plant area consists largely of basalt, a variety of unconsolidated lake- and stream-deposited strata, and loess. Changes in radioactivity level occur at the contact between geologic units at only a few places, however, because of the widespread redistribution of surficial material by wind action in the area. (auth)

23984 (NYO-8922) COSMOGENIC CARBON-14 AND CHLORINE-36 IN METEORITES (thesis). Parmatma S. Goel (Carnegie Inst. of Tech., Pittsburgh). June 4, 1962. Contract AT(30-1)-844. 81p.

Chemical and instrumental techniques were developed for the isolation, purification, and measurement of cosmic-ray-induced C^{14} in both stone and iron meteorites. The isolation of carbon from the silicate materials is done by fusion in an oxidizing flux in a vacuum system. From the iron meteorites the carbon is recovered by the decomposition of the metal in nitric acid in a closed system. For the measurements of weak C^{14} activities special low-level counters were designed and constructed. Gas counting techniques are employed using highly purified CO_2 alone as the counting gas in the proportional region. The radiocarbon contents of 9 stone "falls," 8 stone "finds," and one stony-iron "find" were measured. In stone "falls" the C^{14} activity ranged between 78 and 49 dpm/kg and averaged at 62.5 ± 9.5 dpm/kg. It is shown that the variations are mainly due to the variations in the oxygen contents of these objects. Among 9 stone "finds" (including the stony-iron) examined, 2 had a radiocarbon content at the contemporary level, indicating that their terrestrial ages are less than 2000 to 3000 years. Others contained C^{14} in significantly smaller amounts, showing that most of the stone "finds" are thousands of years old. The oldest among these is Potter, Nebraska in which C^{14} is ≤4.5 dpm/kg (2σ limit) and whose terrestrial age accordingly is ≥21,000 years. A composite specimen of australites and a piece of Libyan Desert-silica glass were examined for C^{14}. Negative results were obtained on both. The implication of these findings on the possible extra-terrestrial origin of the tektites is discussed. C^{14} was measured in the iron "falls" Aroos and Sikhote Alin. In both, the C^{14} activities were consistent with the assumption of a constant cosmic-ray intensity in the past. Among the iron "finds," C^{14} was present in Boxhole, Carbo, and Henbury, with a marginal activity in Odessa. Estimates of the terrestrial ages of these meteorites and the associated craters are given. Absence of C^{14} in Sardis indicated that this meteorite fell some 104 years ago or earlier. Cosmogenic Cl^{36} was measured in 27 specimens of 10 iron meteorites, using low-level counting techniques. An analysis of the available data on Cl^{36} and Be^{10} in iron meteorites showed that in general the Be^{10} activity stays at a fairly constant level (about 4 dpm/kg in small, and about 2.3 dpm/kg in large irons), while the Cl^{36} activity shows wider variations. This was in opposition to the expectations based on proton-induced high-energy nuclear reactions. It is suggested that the observed trend can be explained if it is assumed that π-mesons, which play an increasingly greater role at greater depths, produce Be^{10} in significant amounts. A simple model is proposed which can explain the observed behavior quantitatively by adjusting only two arbitrary parameters. It is shown that, in some iron meteorites containing natural chlorine, appreciable Cl^{36} can be produced by neutron-capture reactions. The measured distribution of Cl^{36} in different pieces of Sikhote Alin and Grant showed that the depth variation for Cl^{36} is steeper than that generally observed for cosmogenic rare gases in iron meteorites. Specimens of Carbo, Aroos, and Canyon Diablo provided supporting evidence for the effect. This disproportional distribution of Cl^{36} and Ar^{38} can be explained on the basis that the meteoroids lose matter from their surfaces by space erosion. Most of the Ar^{38} is produced when the recovered object is rather deep within the meteoroid, so that the resulting depth distribution is rather flat. Quantitative calculations were made, and it is shown that the rate of space erosion for iron meteoroids must be about 0.03 to 0.10 cm My^{-1}. The high erosion rate indicates that the cosmic-ray intensity in the remote past was higher than that at the present. If the intensity varies as $F_t = F_0 \exp(-t/\tau)$ the value of τ must be between 100 and 300 My. An analysis of published K^{41}/K^{40} determinations in iron meteorites strongly supports the above conclusions about the time variation of cosmic-ray flux and the rate of space erosion of iron meteoroids. (auth)

23985 (NYO-9532) STUDIES OF NUCLEAR DEBRIS IN PRECIPITATION. Alan Walton, Edwin L. Fisher, and Philip W. Krey (Isotopes, Inc., Westwood, N. J.). May 31, 1962. Contract AT(30-1)-2415. 54p.

The Be^7 and P^{32} in 14 precipitation samples from Westwood, N. J. were measured for the purpose of studying fall-out mechanisms. After due allowances were made for rainfall amounts, it was calculated that the deposition at temperate latitudes did not differ greatly from that found in tropical regions. Observed deposition rates agreed quite well with expected rates calculated on the basis of entire production of Be^7 and P^{32} within the troposphere. Even minor incursions of stratospheric air into the air masses from which the nuclides were derived were not considered highly likely on the basis of the Be^7/P^{32} ratios observed. Recent tests conducted by Russia resulted in increased deposition of radioactive fall-out at Westwood.

The variability of tritium concentrations in monthly composites of precipitation are reported for the period June 1959 to December 1961. Concentrations varied from a peak of 1790 T.U. in 1959 to a low of 93 T.U. in 1960, with individual rainstorms varying over a wider range. Some correlation was noted in the general behavior of the tritium and total beta concentrations in rainfall. (P.C.H.)

23986 (ORO-545) GRAPHS FOR ESTIMATING ATMOSPHERIC DISPERSION. William F. Hilsmeier and Frank A. Gifford, Jr. (Weather Bureau, Oak Ridge, Tenn.). [1961]. 11p.

Graphs for estimating atmospheric dispersion from continuous point sources are presented based on the generalized Gaussian plume formula. Families of curves of dispersion coefficients vs distance from source were developed. (M.C.G.)

23987 (TEI-811) POROSITY, DENSITY, AND WATER CONTENT DATA ON TUFF OF THE OAK SPRING FORMATION FROM THE U12e TUNNEL SYSTEM, NEVADA TEST SITE, NYE COUNTY, NEVADA. F. M. Byers, Jr. (Geological Survey, Washington, D. C.). Dec. 1961. 62p.

The average porosity of the tuff ranges from about 25 to 40% and generally increases stratigraphically upward. The natural-state bulk density ranges from about 2.10 g/cc in the oldest part to 1.85 g/cc in the youngest part, and varies inversely to the porosity. Average mineral density mostly ranges from 2.3 to 2.5 g/cc, but the red tuff strata average about 2.6 g/cc. Average water content of saturated tuff units that are more than 1000 ft in from the tunnel portal ranges from 14 to 21% by wt. The data are tabulated and discussed statistically. (J.R.D.)

23988 (TEI-817) OUTLINE OF GEOLOGY OF THE U12K AND U12K.01 TUNNELS, AREA 12, NEVADA TEST SITE. Fred N. Houser (Geological Survey, Washington, D.C.). 1962. 44p.

Tunnels were driven in predominantly air-fall tuffs of the Grouse Canyon and Survey Butte Members of the Oak Spring Formation. The tuffs are friable, moderately well bedded to structureless, fine to lapilli, vitric, and crystal vitric tuffs that show pronounced cyclic repetitions of texture, structure, color, and composition. (J.R.D.)

23989 (ZPh-106) TRANSPORT EQUATIONS FOR THE UPPER ATMOSPHERE. I. Oppenheim (General Dynamics/Convair, San Diego, Calif.). June 30, 1961. Contracts DA-04-495-ORD-3112 and AF19(604)-7331. 44p. (AD-269849)

The transport equations which describe irreversible processes in the very dilute, reacting, ionized gas mixture which comprises the upper atmosphere were derived. These equations have application in the description of the properties of the ambient atmosphere and in the determination of the effects of the passage of a traversing vehicle through the atmosphere. The intensity and frequency of the radiation emitted in the traversal of a vehicle through the upper atmosphere will be effected by the phenomena described. (auth)

23990 (AEC-tr-5159) THE EFFECT OF THE RECOIL ENERGY OF NUCLEAR TRANSFORMATIONS IN SOLIDS ON THE SEPARATION OF NATURAL RADIOISOTOPES. K. B. Zaborenko and A. M. Babeshkin. Translated from p.157-67 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. II" (a publication of the International Atomic Energy Agency, Vienna, 1961. (STI/PUB/34 (Vol.II(p.157-67)). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11753.

23991 (AWRE-Trans-34) TURBULENT DIFFUSION IN THE GROUND LAYER OF THE ATMOSPHERE. A. S. Monin. Translated by A. S. Dyer (U.K.A.E.A. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.) from Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz., No. 12. 1461-73(1956). 25p.

Solutions of the hyperbolic equation of turbulent flow in the near ground layer of air with indifferent stratification are investigated. As an example the diffusion of smoke at ambient temperature from a chimney is examined. The generalized expression for diffusion is indicated for cases with arbitrary temperature stratification of the air. (N.W.R.)

23992 SYSTEMATIC ERRORS IN γ-ASSAYING AND POSSIBLE METHODS FOR ELIMINATING THEM. F. V. Kozlov and I. M. Tenenbaum. Atomnaya Energ., 12: 533-6 (June 1962). (In Russian)

In view of the widespread use of radiometric assaying methods which have almost completely replaced other analytical techniques for determining the U content of ores in the field, it is highly desirable to determine their reliability. These methods are based on the measurement of the intensity of γ-radiation of the rocks, transforming this value into equivalent U percentages. The same coefficients were used in these calculations for all the concentration ranges. Comparison of data obtained on the basis of 1408 samples from five U ores by means of radiometric and other methods showed that the reliability of the radiometric method varies with the concentration: higher values were obtained in the low-grade ores than in rich ores, the excess ranged from 31 to 33% in the last case and reached as much as 133% for the U-poor ores. This may be due to following factors: effect of neighboring radioactive ores; back scattering; shift of the radioactive equilibrium; diffusion of Rn from rich ores and deposition of radioactive particles. After determining the effect of these factors experimentally a calibration curve may be drawn for establishing the divergence from the true value at each concentration range. (TTT)

23993 DETERMINATION IN ITALY OF THE BETA RADIOACTIVITY FROM FISSION PRODUCTS IN THE AIR. Comit. Nazl. Energia Nucl., Notiziario, 8: 43-7(Apr. 1962). (In Italian)

The daily determination of the beta activity of fission products in the air at ground level for December 1961 and January 1962 is reported in tabular form. (J.S.R.)

23994 HOW H-BLAST AFFECTED COMMUNICATION LINKS. Electronics, 35: No. 29, 20-1(July 20, 1962).

The effects of thermonuclear blasts on Johnston Island the second week in July on communications are discussed. The test apparently did not cause such severe disruption as was expected. There was no effect on Atlantic circuits; Pacific circuits, in general, recovered to approximately 80% in approximately 5 min, and no major delays were caused in commercial flights. Ways in which h-f and radar may be affected by these blasts are also discussed. (P.C.H.)

23995 RADIOACTIVE ISOTOPES IN COASTAL ENGINEERING. O. Callesen. Ingenioeren (Internat. edit.), 5: 81-4(Sept. 1961).

Experiments and experience gained in Denmark with the use of Cr^{51} for labeling natural quartz sand for investigating littoral drift are described. The conclusions derived from experiments are mentioned, and on the basis of experience gained, the various factors which must be considered when planning such experiments are indicated. It is suggested that related techniques may be applied to other

forms of investigations in connection with the planning of coastal engineering works and the study of associated problems. (OID)

23996 ON AN IMPROVED METHOD FOR DETERMINING LIMESTONE AND SCHIST BY TWO γ-RAY BEAMS. I. Brown (Inst. Cybernetics, Academy of Sciences, Estonian SSR). Izvest. Akad. Nauk Eston. S.S.R., Ser. Fiz. Mat. i Tekh. Nauk, No. 1, 59-66(1962). (In Russian)

An attempt was made to employ two γ beams and a simplified computing procedure for distinguishing schist from limestone at large linear dimension variations. (R.V.J.)

23997 FENGHUANGITE, A NEW APATITE-LIKE MINERAL OF CERIUM EARTHS AND THORIUM. Chi-jui Peng (Inst. of Geology, Academy of Science, Peking), and Yuan-lung Liu. Sci. Sinica (Peking), 11: 677-706(May 1962). (In English and Russian)

Fenghuangite, $(Ca_{.43}\Sigma Ce^{3+}_{.26}Ce^{4+}_{.15}Th_{.18})_5 - (Si_{.6}P_{.24}C_{.16}O_4)_3(OH)$, originated from an urtite which occurs in dikes in biotite foyaite. The coarse-grained rock is composed chiefly of euhedral brick-red nepheline and black melanite with lesser amount of aegirine, orthoclase, fenghuangite, and sphene. These rocks form a part of an alkali igneous complex intruded into limestone of Cambrian age. The fenghuangite is light yellow to brown with a wavy luster and is made up of densely packed prismatic crystal from 0.05 to 0.2 mm long with a hardness of about 5. The mineral dissolves slowly in cold dilute HCl with a slight effervescence but readily in concentrate HCl, H_2SO_4 and HNO_3. The mineral was named after the locality where it was discovered in 1959. (R.V.J.)

23998 PRIMORDIAL RARE GASES IN METEORITE BREITSCHEID. H. Hintenberger, H. Koenig, and H. Waenke (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 17a: 306-9(Apr. 1962). (In German)

Primordial rare gases were found in the chondrite Breitscheid, which shows, like Pantar, light and dark regions. The primordial rare gases are only to be found in the dark portions; they amount to $179 \cdot 10^{-6}$ cm³ STP/g helium and $221 \cdot 10^{-6}$ cm³ STP/g neon. The isotopic compositions of these primordial rare gases were determined by subtraction of the amounts of the radiogenic and cosmic ray produced rare gases measured in the light portions. Possible alterations of the isotopic abundances of the primordial rare gases in the time interval between the end of the nucleosynthesis and their capture in the meteoritic matter are discussed. The radiogenic helium age was determined to be $1.63 \cdot 10^9$ years. (auth)

23999 INVESTIGATIONS OF METEORITES WITH EXTREMELY HIGH NOBLE GAS CONTENT. II. THE CHONDRITE TABOR. H. Koenig, K. Keil, and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 17a: 357-60(Apr. 1962). (In German)

Large amounts of primordial rare gases were found in the spherical bronzite-chondrite Tabor which shows a similar structure as the chondrites Pantar and Breitscheid. The absolute amounts as well as the isotopic compositions of the helium and neon were measured; they are similar to those formerly found in Pantar and Breitscheid. A primordial rare gas ratio $He^4 : Ne^{20} = 540$ was determined; this is the highest value for this ratio found till now in meteorites. (auth)

24000 SKANDII. (Scandium). L. F. Borisenko. Moscow, Publishing House of the Academy of Sciences, 1961. 131p.

Scandium occurs in small quantities (0.0001 to 0.01% Sc_2O_3), in igneous rocks, pre-eminently in dark colored minerals. Maximum content (0.018% Sc_2O_3) was observed in basic rock and minimum (~0.0002% Sc_2O_3) in oxides. Scandium minerals (tortveitite and sterretite) are rare. Admixtures of scandium are found in oxides, tungstates, carbonates, phosphates, and silicates. The highest content (0.01 to 0.4% Sc_2O_3) was found in tantalo-niobates, tungstates, cassiterites, beryl, zircon, and mica. Basically, scandium appears as isomorphous replacement, as heterovalent isomophism it occurs as $Sc^{3+} \rightarrow x^{2+}$ and $Sc^{3+} \rightarrow z^{4+}$. Isovalent Sc replacements occur in yttrium and ytterbium bearing minerals. The richest in scandium (up to 0.4% Sc_2O_3) are tungstates and cassiterites found in greisen-type, high-temperature rare-earth deposits containing niobium. Tortveitite is found in some pegmatites. Extensive bibliographies are included. (R.V.J.)

24001 MARINE BED-LOAD AND DISPLACEMENT STUDIES MADE BY FRENCH ENGINEERS. J. Larras. p.51-7 of "International Congress of Navigation. 20th, Baltimore, 1961. Ocean Navigation. Sect. II." Brussels, Secrétariat Général A.I.P.C.N., 1961.

Chromium-51, Ir^{192}, Sc^{46}, and Ta^{182} were found to be best suited for maritime investigations. For sand labeling, crushed glasses of the same density and approximately the same size as sand were irradiated. The activities applied were 250 Mc of Sc^{46} or Ta^{182} and 1 c of Ir^{192} for 40 to 50 g of glass. A specially constructed immersion and dispersion device is described with which crushed glass can be distributed uniformly at the bottom of the place under investigation with proper precaution for the safety of the workers. The emitted γ radiation can be recorded with a Geiger counter with amplifier, integrator, and registrator fed by a battery. The entire assembly, which is dragged along on the bottom of the sea on a cable by a barge, allows rapid scanning of the bottom surface. (OID)

24002 RADIOACTIVE TRACER STUDIES OFF BOMBAY HARBOR. M. G. Hiranadani and C. V. Gole. p.81-100 of "International Congress of Navigation. 20th, Baltimore, 1961. Ocean Navigation. Sect. II." Brussels, Secrétariat Général A.I.P.C.N., 1961.

A radioactive tracer technique was used to study the deposition of dredged silt from Bombay Harbor. Sc^{46}, a tracer material with the same transport characteristics as the original sediment, and containing an isotope with a half life long enough for it to be traceable for a considerable time and with high γ-activity was used. Boron-free glass was used as the carrier. The glass was ground to obtain a size gradation that was representative of the natural sediment. The graded material was irradiated until its activity reached 27 c. The activated tracer was available for injection for 9 weeks after irradiation with an attenuated activity of 16 c. The method of insertion of the radioactive material and its measurement is described. The detection equipment consisted of 8 Geiger tubes mounted in a 60-cm long Al cartridge, 12.7 cm in dia. (OID)

24003 RECENT RESEARCH ON SAND DRIFT IN JAPAN. M. Nakamichi and N. Shiraishi. p.101-24 of "International Congress of Navigation. 20th, Baltimore, 1961. Ocean Navigation. Sect. II." Brussels, Secrétariat Général A.I.P.C.N., 1961.

Experiences collected in Japan with the use of radioactive tracers in coastal surveys for harbor planning are described. A coastal survey by the analysis of sand and gravel as natural tracers is also described. It was possible to make measurements of Co^{60}-labeled glass up to 45 days after insertion and to take readings of amounts as small as 6 to 32 mc with sufficient accuracy. At the port of Tomakokai, the hydrographic measurement techniques

were further reformed so that a combination of the numerous results obtained through radiometric investigations allows an evaluation of the direction of the littoral drift, the average amount of transported material along the coast, the average depth of the sand layer in motion, and the annual rate of littoral movement. Since the port of Tomakokai is plagued by repeated typhoons, it was of interest to find out to what extent this factor is responsible for the sand erosion. Tracer investigations showed that typhoons contribute only very little to sanding up. (OID)

24004 INVESTIGATION FOR THE EUROPOORT PROJECT. H. A. Ferguson. p.125-40 of "International Congress of Navigation. 20th, Baltimore, 1961. Ocean Navigation. Sect. II." Brussels, Secrétariat Général A.I.P.C.N., 1961.

Radioisotopes were used as tracers for measuring sediment mobility under rough sea conditions at Europoort, which is part of the Rotterdam harbor. Three series of tracer droppings were carried out at several points in the area under investigation. It was concluded that the water current was the dominant factor in sediment transport. Tides and wave motions are only secondary contributing factors to littoral drifts, although the degree to which they influence these drifts depends on location and depth. (OID)

24005 SAND AND SILT MOVEMENT RESEARCH IN PORTUGAL. F. M. Abecasis. p.149-73 of "International Congress of Navigation. 20th, Baltimore, 1961. Ocean Navigation. Sect. II." Brussels, Secrétariat Général A.I.P.C.N., 1961.

In Portugal, Ag^{110} was first used for the measurement of littoral sand and silt movement in open seacoast areas. The isotope was deposited on crushed glass particles similar in form, use, specific weight, and surface characteristics to the natural sand and silt covering the bottom and under investigation. This tracer material was used in investigations conducted at the harbor of Figueira da Foz at the mouth of the Mondega river. Only 1c of Ag^{110} was needed for labeling 5000 kg of sand; 4000 kg of which were dumped in the foreshore near the low water line. Eight hours after dumping, a very sensitive rate meter with a background reading of 200 cpm indicated no more than 500 to 800 cpm at the dumping point, while at points 500 m to the south, 3000 cpm were indicated. The second radioisotope used for sand labeling was P^{32}, which was employed in measurements at Povoa de Varzim, in fishing villages in North Portugal. (OID)

24006 UBERWACHUNG DER RADIOAKTIVITAT IN STAUB- UND REGENNIEDERSCHLAGEN. (Inspection of Radioactivity in Dust and Rain Precipitation). W. Herbst and G. Wiesenack. No. 22 of "Schriftenreihe des Bundesministers für Atomkernenergie und Wasserwirtschaft. Strahlenschutz." Munich, Gersbach Sohn Verlag, 1961. 93p. DM 8.

Monitoring of radioactive fallout from the atmosphere and associated problems were studied. Special routine methods were developed and their efficiency tested. The processes of distribution and deposition of radioactive materials from atomic testing during 1956 to 1960 were studied. The measurement program and the methods used in its accomplishment are described. Results are presented in graph form. (M.C.G.)

24007 YADERNAYA GEOKHRONOLOGIYA. (Nuclear Geochronology). I. E. Starik. Moscow, Publishing House of the Academy of Sciences, USSR, 1961. 630p.

A detailed account is given of basic radiometric methods for determining the absolute geological age of the earth and meteorites. Extensive bibliographies are included. (R.V.J.)

24008 GEOLOGY OF URANIUM AND THORIUM. Bibliographical Series No. 4. (International Atomic Energy Agency, Vienna). 1962. 134p. (STI/PUB/21/4). $1.50. (IAEA).

The bibliography contains 892 references to literature published from 1940 to 1960. Information is given on age, genesis, mineralogy, geochemistry, tests, prospecting and exploration, and reserves of thorium and uranium. The bibliography also includes a guide to literature and a summary giving the present status of the well-known deposits of thorium and uranium. An author index is included. (N.W.R.)

HEALTH AND SAFETY

Refer also to abstracts 23378, 23380, 23384, 24511, 24512, 24513, 24514, 24571, 24648, and 24653.

24009 (CRRIS-1071) SPECIAL EQUIPMENT FOR DECONTAMINATION AND CONTROL OF RADIATION HAZARDS AT CHALK RIVER. C. H. Macfarlane and R. J. Beal (Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.). Mar. 1962. 29p. (AECL-1465)

Some items of decontamination and monitoring equipment developed at Chalk River, the reasons for their construction, and the shape or form of the items are described. Operational performance is also discussed. (auth)

24010 (DLCS-5020100) EMERGENCY PLAN. (Duquesne Light Co., Shippingport, Penna.). [nd.] 165p.

The plan will assure rapid and orderly implementation of those steps which, in the event of an improbable accident, would be required to minimize any hazard to surrounding population. The plan includes required action in case of radioactive discharges in the atmosphere, or liquid radioactive discharges into the Ohio River. (J.R.D.)

24011 (DP-711) PORTABLE BETA-GAMMA SURVEY METER. James O. Blackstone, Jr. (Du Pont de Nemours (E. I.) Co. Savannah River Lab., Aiken, S. C.). May 1962. Contract AT(07-2)-1. 11p.

A GM tube survey meter was developed for general use in monitoring low level beta-gamma radiation. A simple transistor circuit was used to achieve light weight and long battery life. (auth)

24012 (HASL-127) FALLOUT PROGRAM QUARTERLY SUMMARY REPORT, MARCH 1, 1962 THROUGH JUNE 1, 1962. Edward P. Hardy, Jr., Joseph Rivera, nad Robert Frankel (New York Operations Office. Health and Safety Lab., AEC.) July 1, 1962. 240p.

Current data are presented from the HASL Fallout Program, the U. S. Naval Research Laboratory, the New Zealand Department of Scientific and Industrial Research, and the Dominion X-Ray and Radium Laboratory in New Zealand. Radionuclide levels in fallout, milk, tap water, and upper air samples are given in tabular form. Interpretive reports and notes dealing with Sr^{90} levels in foods, wheat, tap water and human bone, stable Sr in an infant diet, and errors in gummed film sampling are included. A bibliography of recent literature pertinent to fallout studies is included. (auth)

24013 (NASA-TN-D-1267) CURRENT ESTIMATES OF RADIATION DOSES IN SPACE. Trutz Foelsche (National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.). July 1962. 51p.

A gross survey of data on energetic radiation in the environment of the earth is presented. The survey embraces the Van Allen belt radiations, galactic cosmic radiations, and solar cosmic radiations associated with solar flares. In the light of current data, the radiation problem is analyzed in terms of shielding requirements to keep exposure down to tolerable limits in manned space flights. The estimates are preliminary, especially in the cases of chance encounter with flare protons, since the available data are incomplete and only allow calculations of upper and lower limits of physical doses. (auth)

24014 (NP-11715) THE POTENTIAL RADIATION HAZARD FROM WATER SUPPLIES AND MILK AFTER A NUCLEAR ATTACK. Eric T. Clarke, Arthur L. Kaplan, and Emerson D. Callahan (Technical Operations, Inc., Burlington, Mass.). Nov. 18, 1960. Revised Apr. 7, 1961. Contract CDM-SR-59-33. 72p. (TO-B-60-27)

Hazards from water and milk contaminated with radionuclides following a nuclear attack are estimated. Results are expressed as expected doses to various critical organs due to ingestion of water from a reservoir or standard depth, or due to drinking milk from cows grazing in a field situated in a region receiving fall-out of standard gamma ray intensity. Methods for removal of fall-out material from food and water are also reviewed. It is pointed out that the most serious hazard arises from iodine isotopes in both milk and water and from intestinal irradiation by gross fission products in water. However, it it also shown that, under reasonable assumptions about scale of attack, only 2% of the U. S. area outside the blast regions will be contaminated to 4000 roentgens (2 day dose), a degree sufficient to present a significant hazard of radiation sickness from drinking reservoir water. Cows outdoors in this area will be unlikely to survive to produce milk, though. (auth)

24015 (TID-15985) RESEARCH ON THE HAZARDS ASSOCIATED WITH THE USE OF LIQUID HYDROGEN IN BUBBLE CHAMBERS. Final Report No. 3861. Michael G. Zabetakis, Aldo L. Furno, and Henry E. Perlee (Bureau of Mines. Explosives Research Lab., Pittsburgh). May 28, 1962. 57p.

The hazards arising in H bubble chambers from window failure, or other failures such as vacuum tanks or vent systems were investigated. Special efforts were made to determine the nature of glass window failures, the results expected from glass fragment impingement on materials, vent system performance, characteristics of H detection systems, ignition of H–air mixtures, and the results of such ignition in closed places. (J.R.D.)

24016 (WT-789) PHYSICAL MEASUREMENTS OF GAMMA AND NEUTRON RADIATION IN SHELTER AND INSTRUMENTATION EVALUATION. L. J. Deal, H. H. Rossi, G. S. Hurst, et al. (Division of Biology and Medicine. Radiation Instruments Branch, AEC). Aug. 1953. Project 24.2 [of] Operation UPSHOT-KNOTHOLE. 37p.

Gamma and neutron measurements were made inside group shelters during Upshot-Knothole 1 (Mar. 17, 1953) and Upshot-Knothole 8 (May 19, 1953). Gamma measurements were made with film dosimeters; total-dose and neutron measurements were made with tissue equivalent (rep) chambers and fission threshold detectors. Sufficient data were recorded to provide a good base for evaluation of the radiological protective features of the shelters. It was demonstrated that fission threshold detectors, used in conjunction with gold and sulfur, will give the information needed for calculating the first collision tissue dose, thereby leading to a better interpretation of the radiation dose from neutrons. (auth)

24017 (WT-798) EFFECTS OF OVERPRESSURES IN GROUP SHELTERS ON ANIMALS AND DUMMIES. J. E. Roberts, C. S. White, and T. L. Chiffelle (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). Sept. 1953. Project 23.15 [of] Operation UPSHOT-KNOTHOLE. 60p.

Relative biological hazards of blast were studied in two types of communal air-raid shelters during Shots 1 and 8. Dogs, restrained within the shelters during detonation,

were studied pathologically and clinically for blast injuries. Two anthropometric dummies were test objects for displacement studies utilizing high-speed photography. Physical data included pressure vs time and air-drag determinations. During Shot 1, animals sustained marked blast damages (hemorrhages in lungs and abdominal organs), three dogs were ataxic, and the dummies were rather violently displaced. In Shot 8, however, no significant injuries were found in the animals, and the dummies were minimally displaced. Analysis of the physical data indicated that blast injuries and violent displacements may occur at much lower static overpressures than previously assumed from conventional explosion data. Furthermore, biological damage appeared to be related to the rate of rise of the overpressure and air drag, as well as the maximum overpressure values. (auth)

24018 (WT-1161) EFFECTS OF AN ATOMIC EXPLOSION ON GROUP AND FAMILY TYPE SHELTERS. L. J. Vortman (Sandia Corp., Albuquerque, N. Mex. and Federal Civil Defense Administration, Battle Creek, Mich.). Dec. 1955. Projects 34.1 and 34.3 [of] OPERATION TEAPOT. 185p.

Two underground shelters (50-man capacity), one open and one closed, were exposed to Apple I shot, and two were exposed to Apple II shot (at 1050 ft). Three basement exit shelters were exposed to Apple I shot at 1350 ft; four were exposed to Apple II shot, two at 1270 ft, and two at 1470 ft. Groups of three aboveground utility type shelters, one of masonry blocks, one of precast reinforced concrete, and one of poured-in-place reinforced concrete, were placed at 2250, 2750, and 3750 ft from Apple II shot. Reinforced-concrete bathroom shelters were placed in rambler type houses at 2700 and 10500 ft from Apple II shot. Three types of basement shelters were constructed in two frame houses at 5500 and 7800 ft, and two types of basement shelters were constructed in two brick houses at 4700 and 10500 ft from the same burst. On neither shot was structural damage sustained by the large underground personnel shelters. Occupants of the closed shelter would not have been disturbed by blast, debris, or radiation. Damage to the basement exit shelters was inversely proportional to their distance from Ground Zero (GZ) and was directly proportional to the amount of opening in the entrance. The closed shelter at the greatest distance received the least damage but was not satisfactory as a personnel shelter at the lowest pressure tested. Utility shelters provided unsatisfactory protection from radiation. All indoor family type shelters were satisfactory as tested and would have provided adequate protection for occupants. (auth)

24019 (WT-1453) TEST OF FRENCH UNDERGROUND PERSONNEL SHELTERS. Edward Cohen and Norval Dobbs (Ammann and Whitney, New York). June 1960. Project 30.6 [of] OPERATION PLUMBBOB. 296p.

An investigation is described concerning the blast-stress behavior of French underground personnel shelters, equipment and instrumentation. Five reinforced-concrete underground structures were tested including one cast-in-place rectangular structure, one precast circular shelter, two entranceways at about the 116-psi peak overpressure range, and one entranceway at about the 105-psi range. Instrumentation is described along with biological tests. Detailed drawings and a discussion of resulting data are included. (J.R.D.)

24020 (WT-1454) TEST OF GERMAN UNDERGROUND PERSONNEL SHELTERS. Edward Cohen and A. Bottenhofer (Ammann and Whitney, New York). July 1960. Project 30.7 of Operation PLUMBBOB. 258p.

The predicted behavior of German underground personnel shelters, equipment, and certain instrumentation was investigated. Data obtained will be used for evaluation and improvement of present design criteria. Nine reinforced-concrete underground shelters, designed by German engineers, were tested at the 170-, 155-, 110-, 78-, 26-, 11.5-, and 7.2-psi overpressure ranges as determined from average blast-line instrumentation measurements. Reinforcing steel, doors, and ventilation equipment were received and incorporated in the shelters. Preshot and postshot precise location surveys were made to determine the total lateral and vertical motions of the structure as a result of the blast. Blast instrumentation used in the shelters and entranceways consisted of pressure gauges, earth-pressure gauges, self-recording pressure gauges, and dynamic pressure gauges. Free-field measurements were recorded along the blast line using U. S. self-recording and electronic pressure gauges and German self-recording pressure gauges. Structural response was recorded by deflection and acceleration gauges, strain gauges, and scratch gauges. Radiation measurements were taken using U. S. gamma-radiation film dosimeters, gamma-radiation chemical dosimeters, neutron detectors, telemetering gamma dosimeters, and German gamma chemical dosimeters. Mice were used as biological specimens in environmental tests in seven of the nine structures tested. In addition to the environmental tests, a series of tests was performed in the nine structures to check for the possible occurrence of dust in the shelters as a consequence of nuclear explosions. Ground shock spectra were recorded for free field conditions and for the interior of a shelter. An experiment was included to investigate the transmission of ground shock acceleration to a simulated body. This test recorded the shock-absorbing characteristics of a commercial product. (auth)

24021 (CEA-tr-A-1002) FILTRE ÉLECTROSTATIQUE POUR LA SÉPARATION DES AÉROSOLS RADIOACTIFS. (Electrostatic Filter for the Separation of Radioactive Aerosols). W. Riezler (Riesler) and W. Kern. Translated into French by P. Monnard from Nukleonik, 1: 191-5(Apr. 1959). 23p. (Includes original, 5p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 11806.

24022 RESEARCH ON THE RADIATION HAZARD TO FLIGHT CREWS AND GROUND PERSONNEL FOR JET AIRCRAFT. II. MEASUREMENT OF OUTER SURFACE CONTAMINATION OF JET PLANES. O. C. Allkofer, E. Bagge, and J. Truemper (Institut für Reine und Angewandte Kernphysik, Kiel). Atomkernenergie, 7: 204-16(June 1962). (In German)

The surface of a jet will be contaminated from atomic explosions while flying in the upper atmosphere. Investigations about the contamination were made on the jets of the type Boeing 707 and 720 B of the Deutsche Lufthansa in spring 1961 and in autumn 1961 after a new series of nuclear explosions in the atmosphere. The measurements were performed on all routes of the Deutsche Lufthansa by wiping well defined areas of the surface and by measuring the activity of sticky foils. It was shown that the degree of contamination is dependent on the mean flight hours spent in the stratosphere. A mean activity of 5.10^{-3} $\mu c/m^2$ was found in spring 1961 on all flying routes. The surface contamination showed large fluctuations in the autumn measurements. The mean activity was larger by a factor of 26 in autumn. The largest contamination was 65 $\mu c/m^2$. The intensity of beta and gamma radiation was determined among all the components: in spring 1961 74% beta and

26% gamma activity were found; in autumn the numbers were 62% and 38% respectively. The ingestion hazard due to the beta component for those members of the servicing staff who have contact with the surface of the jet was determined. It was shown to be unimportant if some single precautions like cleaning hands are observed. (auth)

24023 RADIOISOTOPES FROM FALL-OUT IN THE MILK DISTRIBUTED TO THE POPULATION OF MILAN. (NOVEMBER-DECEMBER 1961). A. Malvicini (Euratom, Ispra, Italy) and C. Polvani. Comit. Nazl. Energia Nucl., Notiziario, 8: 19-27(Apr. 1962). (In Italian)

The radioactivity in milk distributed to the Milan population during the last two months of 1961 was accurately measured, and the results obtained were compared with results from previous months. The presence of short- and long-lived radioisotopes was detected. Some such as I^{131}, Sr^{89}, Sr^{90}, and Cs^{137} were readily found, but others such as Ba^{140}, Ru^{103}, Zr^{95}, and Nb^{95} were detected less frequently. (J.S.R.)

24024 RADIOACTIVITY FROM IODINE-131 IN THE MILK IN SOME ITALIAN CITIES. Comit. Nazl. Energia Nucl., Notiziario, 8: 43(Apr. 1962). (In Italian)

The results of the daily measurement of the I^{131} activity in the milk of six Italian cities — Milan, Bologna, Livorno, Rome, Bari, and Catania — from Nov. 29 to Dec. 31, 1961, are reported in tabular form. (J.S.R.)

24025 FINANCIAL PROTECTION BY ATOMIC HAZARD INSURANCE. Franco Micucci Cecchi. Europa nucleare, 5: No. 2, 33-8(Mar.-Apr. 1962). (In Italian)

Insurance against atomic hazards, giving adequate financial protection to persons and goods, introduces novel consideration. The evaluation of the hazard, the number of people insured, and the establishment of causality between radiation exposure and damage are problems peculiar to nuclear energy. The insurance market in the European countries and the United States and the possibility of government subsidy are discussed. (J.S.R.)

24026 FIELD BOUNDARY AND SCATTER RADIATION IN HIGH-ENERGY RADIATION. R. Janker and Kh. Renner. Fortschr. Gebiete Rontgenstrahlen u. Nuklearmed., 96: 545-50(Apr. 1962). (In German)

Measurements of scattered radiation were carried out for 16-Mev and Co-60 gamma amd 200 kv both in a Plexiglas phantom which is comparable with the human body and on a patient. It was established that in the immediate neighborhood of the field edge scatter decreases with increasing energy. At greater distances from the edge of the field, however, such as between 20 and 30 cm, the relationship between scatter and energy is the reverse, scatter increasing with increasing energy. Even inside the body scatter at 16 Mev is more than 100 times that at 200 kv conventional radiation. Also the neutron doses which are produced must be taken into consideration. Implications for the treatment of patients with high energy radiation are discussed. (auth)

24027 SAFETY OF NUCLEAR REACTORS. Intern. At. Energy Agency Bull., 4: No. 3, 3-7(July 1962).

A summary is given of the papers and discussions presented at the Symposium on Reactor Safety and Hazards Evaluation Techniques in Vienna on May 14 to 18, 1962. It is stated that the problem is to obtain adequate reactor safety without incurring an economic penalty. The human factor in reactor safety and changes in siting and containment criteria are discussed. (D.L.C.)

24028 X- AND GAMMA FILM DOSIMETRY. Jaroslav Beneš (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, [Prague]). Jaderná energie, 8: 122-5(1962). (In Czech)

Basic principles, advantages, and disadvantages of x and gamma film dosimetry are surveyed. (auth)

24029 RADIATION SAFETY REQUIREMENTS FOR INDUSTRIAL RADIOGRAPHY USING RADIOISOTOPES. A. K. Das Gupta (Dept. of National Health & Welfare, Ottawa). Nondestructive Testing, 20: 238-41(July-Aug. 1962).

Causes of 11 accidents from radiographic operations are analyzed. Four minimum conditions set forth to make radiography safe are: adequate supervision by a responsible person, training of radiographers, use of properly designed equipment and adequate maintenance, and correct procedures. Discussion is given on each of these requirements. (P.C.H.)

24030 PROBLEMS OF RADIATION HYGIENE IN AGRICULTURE AND AGRICULTURAL RESEARCH. Jaromír Chyský. Pracovní lékařství, 14: 130-3(Apr. 1962). (In Czech)

An account is given of the results of sanitary investigations in several agricultural departments where radioisotopes are used as well as experience regarding the evaluation of projects for building and adapting buildings of seven agricultural institutes and laboratories where research with isotopes will be conducted. (auth)

24031 PHYSICO-CHEMICAL AND MEDICAL CONSIDERATIONS ON THE DANGER OF RADIATION DAMAGE IN THE IRON AND STEEL INDUSTRY. A. Krausz and F. Wechselberger. Radex Rundschau, No. 1, 492-505(Feb. 1961).

Section I of this article gives the basic principles of dosimetry including radioactive equilibrium and activity, and an extensive mathematical treatment. Section 2 deals with permissible radiation doses for (1) people working with ionizing radiation, (2) people not working directly with radioactive sources but close to these sources, and (3) the total population. Section 3 is devoted to considerations of physico-chemical reactions induced by radiation in biological substances, and section 4 is concerned with radiation damage and radiation protection. Each of the various types of radiation (α, β, γ, and neutron radiation) are considered separately. The final section deals with the use of radioisotopes in industry, particularly for the production of pig iron. Radioisotopes are used to measure the wear of blast furnace walls, in metallurgical investigations, for studies of gas composition, gas flow, gas pressure, metal and sinter flow, etc. (OID)

24032 KERNWAFFEN UND KERNWAFFENSCHUTZ. (Nuclear War and Nuclear War Protection). Translated from "Atomnoe Oruzhie i Protivoatomiaya Zashchita." [Berlin], Verlag des Ministeriums fur Nationale Verteidigung, [1960]. 354p.

The present edition should give to those in the army, air defense, and other institutions concerned with nuclear warfare an accurate survey on the principles, construction, and effects of nuclear war. Topics discussed include the structure of matter, nuclear war, the pressure wave, light radiation, ionizing radiation, activation of the land, radiation protection in the open, calculation of shielding factors, dosimetry, and precaution for radiation protection in active zones. This German translation of the Soviet edition was edited to some extent with various errors being corrected and the latest data being substituted. (J.S.R.)

24033 RADIOSTRONTIUM AND RADIOCAESIUM IN DRINKING WATER IN THE UNITED KINGDOM. 1961 Results. (Gt. Brit.). 19p. $0.21(BIS).

During 1961 the concentration of Sr^{90} and Cs^{137} was measured regularly in twenty-three public drinking waters.

None was found in well-derived waters. In the only water derived from a chalk stream, Southampton, the level of Sr^{90} was low (0.029 picocurie/litre). In the river-derived waters except Southampton and London the average level of Sr^{90} was 0.18 picocurie/litre: London's water was somewhat higher than this average (0.25 picocurie/litre). Excluding the Thames-derived London water (the average level of which was 0.84 picocurie/litre) the average level of Cs^{137} in river-derived waters was 0.023 picocurie/litre. The level of Sr^{90} in impounded waters ranged from 0.24 to 0.80 picocurie/litre; the average level was 0.52 picocurie/litre. The level of Cs^{137} in impounded waters was generally low (0.14 picocurie/litre) but Glasgow and Belfast were higher (0.46 and 0.55 picocurie/litre, respectively). The average daily ingestion of Sr^{90} and Cs^{137} in drinking water in 1961 is estimated at 0.25 and 0.13 picocurie per person, respectively. (auth)

24034 ZASHCHITA OT RENTGENOVSKIKH I GAMMA-LUCHEI. (Protection Against Roentgen and Gamma Rays. Second Improved and Supplemented Edition). A. V. Bibergal, U. Ya. Margulis, E. I. Vorob'ev, and ed.-in-chief, K. K. Aglintsev. Moscow, Medgiz, 1960. 273p.

An extensive compilation of information is given on problems in radiation protection. Diagrams, tables, nomograms, and other data are included for use by personnel handling radioactive materials. (R.V.J.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Refer also to abstracts 24568, 24569, 24570, 24572, 24582, 24584, and 24585.

24035 (NYO-9851) UTILIZATION OF RADIOACTIVE ISOTOPES IN COAL PROCESS RESEARCH. Quarterly Technical Status Report No. 12, March 1, 1962–May 31, 1962. P. M. Yavorsky, E. Gorin, and J. L. Freeman (Consolidation Coal Co. Research and Development Div., Library, Penna.). July 1, 1962. Contract AT(30-1)-2350. 23p.

A radiotracer study was completed on the rate of segregation of pyrite bearing coal particles as a function of size and density in a 8 × 48 M bed of coal fluidized with water. The data are useful for calculation of the rate and efficiency of cleaning coal in this size range by the water fluidization method. Results of a tracer study are also given for a 3-inch hydroclone. The efficiency of separation of radiotracer pyritic particles of varying size and density injected into a 48M × 0 coal water slurry was measured for a variety of experimental conditions. Conclusions are also given that relate the Fe^{59} to pyrite and the Sc^{46} to the organic matter in coal. These two are the prominent isotopes in neutron activated coal-pyrite tracers. (auth)

24036 (AEC-tr-5096) INVESTIGATION OF THE SURFACE PASTEURIZATION, BY MEANS OF SOFT X-RAYS, OF PACKED SAMPLES OF FISH AND MEAT CONTAINING INNER BACTERIA. A. Schmidt-Lorenz and A. Berger. Translated from Intern. J. Appl. Radiation and Isotopes, 11: 161-73(1961). 17p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 2853.

24037 (AEC-tr-5189) RADIOISOTOPIC CONTROL OF WEAR ON THE SUSPENSION BEARINGS OF LARGE TURBOGENERATORS. E. Frynta, F. Kkhol', and V. Kopetskiĭ. Translated from p.381-5 of "Proceedings of the Conference on Radioisotopes in the Physical Sciences and Industry, held in the Physical Sciences and Industry, held in Copenhagen, September 6-17, 1960. Vol. I." (A publication of the International Atomic Energy Agency, Vienna, 1962.) (STI/PUB/20(Vol.I(p.381-5))).

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 16065.

24038 (AEC-tr-5191) MEASUREMENT OF DIFFUSION COEFFICIENTS FOR SILICATE MELTS WITH Na-24, K-42, AND Ca-45. V. L. Malkin and B. M. Mogutnov. Translated from p.169-78 of "Proceedings of the Conference on Radioisotopes in the Physical Sciences and Industry, held in Copenhagen, September 6-17, 1960. Vol. I." (A publication of the International Atomic Energy Agency, Vienna, 1962.) (STI/PUB/20(Vol.I(p.169-78))). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 16048.

24039 THE USE OF VARIOUS FORMS OF RADIATING ENERGIES FOR THE PRESERVATION OF FOODS. Sabato Visco. Acta Chim. Acad. Sci. Hung., 23: 445-67(1960).

A survey of results of the effects of ionizing irradiation on foods indicated that nuclear radiation does not cause acute or chronic illness, the formation of cancer-producing materials, or radioactive properties. But almost all irradiated foods show changes in color, smell, taste, and consistency. The changes in nutritive values of the foods depend upon their composition: meats and proteins of cereals and legumes show noticable changes, while proteins are affected strongly (partial destruction of cystine). Changes in vitamin content depend on the type of food and the irradiation dose. It was found also that the basic food substances, in their pure form are affected much more by irradiation than as components of food. Current research is focused on the changes in taste, color, smell, etc., and the addition of compounds which would prevent these changes. The application of radiation was successful in controlling insects in stored grain, delaying the germination of bulbs and tubers, sterilizing salmonella eggs, and treating pork affected by trichinae. A definite evaluation of the new methods is, at present, not possible; however, the results achieved to date are very promising. (OID)

24040 THE PRESERVATION OF FOODS WITH IONIZING RADIATION. THE APPLICATION TO MILK, CHEESE, MEAT, FISH, AND VEGETABLES. Josef Herrmann. Acta Chim. Acad. Sci. Hung., 23: 503-11(1960).

The following radiation sources may be used in industrial applications: for β rays: electron accelerators, for γ rays: the isotopes, Co^{60} and Cs^{137}, and in a limited range the roentgen tube. The main distinction between these is the depth of penetration and in the case of the Capacitron (electronic flash), a high dose power. An increased dose produces these positive results: decrease in germination and delay in ripening of stored fruit and vegetables, control of parasites, bacteria, etc. Secondary undesirable effects produce alterations in taste, color, destruction of components, etc. These effects were studied for the various foods. A critical evaluation from the standpoint of practical and economic usefulness is given. (OID)

24041 THE ACTION OF γ-RAYS ON THE TECHNOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF FLOUR. F. Sandret, A. Guilbot, and J. Buré. Acta Chim. Acad. Sci. Hung., 23: 513-27(1960).

The effect of Co^{60} γ radiation on two types of soft wheat flour was studied: (a) commercial flour of medium good milling value (Wat Chopin alveograph = 134); moisture content = 14.5%; irradiation; 2.5×10^4 to 3×10^6 rads. (b) Flour of high milling value (Magdalema wheat, W = 300); moisture content = 12.50% in wheat and 12.85% in flour; irradiation 10^4 to 10^6 rads. The results were the same for all three series of samples: color: above 5×10^5 rads-brownish; milling value: with less than 5×10^5 rads, slight increase in W, above 10^6 rads W decreased noticeably; amylolysis: the maximum level of gelification was lowered slightly (10%) above 10^5 rads, greatly lowered (50-60%) above 10^6 rads; fermentation power: normal up to 10^6 rads, above 10^6 rads, slower (CO_2 production; baking test). Flours irradiated at 5×10^4 rads gave a better looking and more developed bread. At 1.5×10^5 rads an abnormal smell appeared. Above 2×10^6 rads, the flour was almost unbakable. Glucides and reducing power: no change. Nitrogenous substances: progressive increase above 5×10^5 rads of protide fraction soluble in 10% trichloracetic acid. Lipid fraction: formation of peroxides. Enzyme activity: lessened, especially above 10^5 rads. (OID)

24042 MICROBIOLOGICAL PECULIARITIES AND PROBLEMS OF THE STERILIZATION OF FOOD PRODUCTS BY IRRADIATION. M. N. Meisel and M. N. Poghasova. Acta Chim. Acad. Sci. Hung., 23: 529-33(1960).

It has been established that methods combining heat treatment with irradiation are the most effective. Biological studies proved that in organisms irradiated, new, biologically active agents could be formed. In order to be able to use smaller doses for sterilization purposes, it is important to increase the irradiation sensitivity of microorganisms. This way leads to the solution of some of the problems of irradiation-sterilization. (OID)

24043 THE INFLUENCE OF EXTERNAL CONDITIONS ON THE RESISTANCE OF YEASTS TO RADIATION. T. S. Romessova. Acta Chim. Acad. Sci. Hung., 23: 535-9(1960).

Comparative tests were performed on 18 types of microorganisms. It was found that various species possess different radiation resistances which in turn are influenced by the external conditions and the direction of metabolism. Especially noticeable in reduced resistivity is a reduction in the breathing system. (OID)

24044 OBSERVATIONS ON THE EFFECTS OF IONIZING RADIATION ON VARIOUS FOOD PRODUCTS. Marta Blisc. Acta Chim. Sci. Hung., 23: 555-6(1960).

The effects of ionizing radiation on the following were surveyed: For potatoes and onions—better storage conditions during winter and spring, the germination process was delayed, and infection by microorganisms was reduced. For sugarbeets—good storage, and the sugar content increased 1 to 1.5%. Meats, fish, poultry—radiation of fresh articles, in addition to cooling. Vegetables-irradiation at low temperatures increased the duration of preservation. Flour and bread—quality increased in flour on irradiation with 30,000 to 100,000 rep of Co^{60}, compressibility of bread, elasticity and porosity of the crusts, flavor, etc., increased. (OID)

24045 COMBINED METHODS FOR THE PRESERVATION OF FOOD: ANTIBIOTICS, REFRIGERATION, AND RADIATION. José Antonio Muñoz-Delado Ortiz. Acta Chim. Acad. Sci. Hung., 23: 577-91(1960).

Part 2 of the paper deals with the preservation of food products with cold and ionizing radiation. A short introduction on radiation sources is followed by a discussion of the essential effects of radiation on various food products and the positive effect of cold on the suppression of unwanted accompanying effects is mentioned. The possibility of using ionizing radiation as a preliminary treatment for foods that spoil quickly was investigated. Radiopasteurization is recommended as a form of sanitation for foods prior to cold treatment for preservation. It was found that radiopasteurization does not have the undesirable secondary effects usually caused by radiosterilization. (OID)

24046 RADIATION SOURCES AND RADIATION COSTS. R. de Raad. Atoomenergie, 4e: 67-73(Apr. 1962). (In Dutch)

A review is given of important radiation sources for industrial utilizations, the laws concerning radioisotopes, accelerators, and chemonuclear reactors. The present-day and potential radiation costs were discussed. It is evident that important cost reductions can only be obtained through the development of accelerators with large capacity and chemonuclear reactors, with which really large production capacities can be achieved. (tr-auth)

24047 INSTRUMENTATION AND AUTOMATION IN PLANTS OF THE CHEMICAL AND OIL INDUSTRY. G. Pistonesi. Automazione e strumentazione, 9: 266-75 (July 1961).

In a comprehensive survey of recent developments in the field of instrumentation and automation in the chemical and petroleum industry, radioisotopes are mentioned with respect to measurements by means of nuclear radiation, especially γ rays. Here practical and economical solutions for difficult measurement problems have been devised and are already applied to (a) level gaging, (b) density measurements, (c) observation of chemical reactions, and (d) measurement of wear of apparatus and of their corrosion. All these measurements can be used with electronic relays for automation and control. Radioisotopes are applied in the food industry for processing fruit juices, in the evaporation and concentration of milk, the manufacture of chocolate, etc., and for nondestructive testing of chemical machinery and instruments which are exposed to great stress due to high temperature and the corrosive nature of many chemical substances and reactions. By using x rays or γ rays, the effects of these factors can be followed during chemical operations, and the nature of corrosive destruction can be determined qualitatively and quantitatively. (OID)

24048 THE MEASUREMENT OF THE HUMIDITY OF BUILDING MATERIALS WITH γ-RADIATION ISOTOPES. Werner Stolz. Bauplanung u. Bautech., 16: 500(Oct. 1961).

When γ rays of intensity, I_0, pass through a material sample, they are attenuated, depending on the thickness, density, and humidity of the sample according to the law: $I_1 = I_0\, e^{-\mu d}$, where μ is the absorption coefficient and d is the density. The absorption of γ rays by the humid material consists of the dry matter and the water content so that $I_2 = I_0\, e^{-\mu d - \mu_\omega d_\omega}$ from which the relationship is obtained: $\ln(I_1/I_0) - \ln(I_2/I_0) = \mu_\omega d_\omega$, where μ_ω is the absorption coefficient of water. The water content, d_ω, is $(1/\mu_\omega)\ln(I_1/I_2)$. By using Co^{60} or Cs^{137} as radiation sources and a Geiger or scintillation counter as the detector and arranging the radiation so that the standard (dry) material and a sample are irradiated simultaneously, I_1 and I_2 can be determined with an accuracy of 2%. (OID)

24049 THE PRODUCTION AND USE OF RADIOELEMENTS IN BELGIUM. Rene Constant. Bull. inform. assoc. belge develop. pacifique énergie atomique, No. 28, 19-26(Sept. 1960).

A survey is given of the present position of the radioisotope industry in Belgium. I^{131}, P^{32}, Au^{198}, and S^{35}, are the principal isotopes produced, and examples of their application are given. Problems of physical, chemical, and biological control during production are discussed. The statistical aspects are presented in graphs. (OID)

24050 THE DEVELOPMENT OF INTENSIVE RADIATION SOURCES. R. Eymery. Bull. inform. A.T.E.N., No. 28, 1-4(Mar.-Apr. 1961).

The only industrially used isotope of high energy emission is Co^{60} which is obtained by activation of Co in the atomic reactor. There could be many more high energy sources utilized which, at the present time, have not been used industrially. The spent atomic fuel bars are of great economic interest, but the rapid decrease of their activity would require their frequent renewal and this would not be feasible economically. The enriched U bars have a high specific activity, but their high self-absorption makes them less practicable as industrial radiation sources. The extraction of several long-living fission products, especially Cs^{137}, would be feasible but this is too difficult and expensive at the present time. The price of energy from particle accelerators increases, although the production costs diminish. Exact radiation costs are difficult to establish, but they are still very high so that only very expensive products can support the costs (such as sterilized surgical

products which require 25 Mrad). However, if weak radiation is sufficient for irradiating meat (200,000 rad) or preventing potato sprouting (10,000 rad), the use of radiation appears very promising. Recent studies on the economics of radiation have shown that the use of radiation in chemical industry would be feasible only if the radiation costs were $^1/_{10}$ of what they are today. A short review of the present status of industrial radiation in the world is given. (OID)

24051 RADIOISOTOPES AND THEIR APPLICATIONS; THE INDUSTRIAL USE OF RADIOELEMENTS. J. Perette. Bull. Inform. A.T.E.N., No. 28, 10-15(Mar.-Apr. 1961).

The expansion of Euratom and Foratom into the field of industrial application of radioisotopes is taken as an occasion to review the present status of industrial use of radioisotopes. A distinction is made between sealed and open radiation sources. The former are used for initiating chemical reactions, such as polymerization or for food preservation, elimination of static electricity, thickness measurement, sources of luminescence or electricity, radiography, nondestructive quality control, and in the automatization of chemical or mechanical processes. α, β, and γ radiation sources, direct irradiation or backscattering, bremsstrahlung, and the x rays released by β radiation are used. Open radioisotopes are used as tracers in the most diverse fields of scientific research and industrial control. Two special forms of open usage of the radioactive gas, Kr^{85}, should be mentioned: (a) detecting the tightness of containers by placing them in a Kr^{85} containing vessel and determining whether the container after removal from the vessel shows some radioactivity; and (b) detecting tracers of O_2 or SO_2 with an organic "clathrate" containing Kr^{85} which by the action of the substance to be detected is released and thus can be measured radiographically. (OID)

24052 COLD STERILIZATION OF FOOD AND PHARMACEUTICAL PRODUCTS. Dorothy M. Smith. Ciencia (Mex.), 19: 262-3(Apr. 25, 1960).

The possibility of sterilization by ionizing radiation opens a new era in the food industry. The units of absorbed radiation are the "rep" and the "rad." The lethal dose for humans is 800 rep, for bacteria 1 to 4×10^6 rep, for toxins and enzymes 5×10^6 rep. The most effective and economic radiation sources are radioisotopes. However, upon irradiation of food products with sufficiently large doses, chemical side effects were observed which caused undesirable color or organoleptic changes. This is especially true in cases of meat and meat products, grain and grain products, vegetables, oils, fats, milk and milk products. The sterilization of pharmaceutical products by means of irradiation is more promising, e.g., such products as hormones and antibiotics can be irradiated in sealed containers up to 10^6 rep without losing their physical or physiological characteristics. (OID)

24053 THE IMPORTANCE OF EXTERMINATING INSECTS IN WAREHOUSES FROM THE VIEWPOINT OF NATIONAL ECONOMY AND A NEW WAY OF INSECT CONTROL: IONIZING RADIATION. Gábor Toerocik and József Farkas. Élelmezési Ipar, 14: 199-206(July 1960).

The extent of damage caused by insects is demonstrated by statistical data. The insects most frequently occurring are described. A review is given of the effect of ionizing radiations on insects as described in related literature. The possibilities of the application of ionizing radiations for insect killing in the food industries are examined and economic aspects are discussed. (OID)

24054 THE USE OF NUCLEAR RADIATIONS IN PURIFYING USED WATERS. E. Gaspar and D. Serban. Hidrotechnica (Bucharest), 6: 253-6(July 1961).

Laboratory results obtained from the employment of nuclear radiations (Co^{60}) for the purification of used waters are discussed. The manner in which a practical solution of the problem can be achieved in the case of an industrial installation consisting of vertical decantation apparatus with one or more radioactive sources is discussed also. (OID)

24055 RADIOACTIVE LUMINOUS PAINTS. Reinhold Wahl. Ind.-Lackier-Betrieb, 29: 101-7(Apr. 1961); 186-91 (June 1961); and 219-22(July 1961).

The first 2 parts of this series discuss in a very popular but instructive manner the scientific foundations of radioactive luminescence, including the history of radioactivity, the structure of the atom, radioactive decay and α, β, γ radiation, natural and artifical radioisotopes, light production through radioactivity, and processes involved in radioactive luminescence. In the 3rd part, the main source of light emission, namely, α radiation, is discussed and on the basis of the radioactive equilibrium, the question concerning the number of α particles participating in light production is answered. This leads to the discussion on the nature and manufacture of luminescent paints and pigments, which use Ra in their preparation in the amount of only 0.0001%, preferably in the form of $RaBr_2$ or $RaCl_2$, while the bulk is a mixture of binding and luminescent substances which are completely inactive. A short survey is given of methods for preparing radioactive pigments and the protective measures which must be observed for guarding the workers against hazards while working with concentrated radioactive material. (OID)

24056 RADIOACTIVE LUMINOUS PAINTS. Reinhold Wahl. Ind.-Lackier-Betrieb, 29: 251-4(Aug. 1961); 295-7 (Sept. 1961).

Part 4 discusses the life duration of radioactive paints and pigments, which in the case of Ra with a half life of 1620 yr is not determined by the radioactive emitter, but by the effect of radiation upon the luminescent material, such as ZnS, which is destroyed slowly by the continuous bombardment with α particles as well as by external atmospheric influences on the binding material. The less frequently used emitters, mesothorium and radiothorium, are discussed briefly. In the 5th part, the "cold light" of luminescence is compared with the "hot light" of other light sources (gas, acetylene, candle light, incandescent bulbs, etc.). The two types of cold light, namely, "fluorescence" and "photoluminescence," are discussed, and living light sources, "bioluminescence," are mentioned. The series closes with a short review of development trends and a preview of the future of the industry of radioactive paints and pigments, especially in connection with the expanding atomic industry, which makes radioisotopes available for more economical conditions. Only the future will tell whether this may lead eventually to the use of β emitters as activators in luminescent paints. (OID)

24057 RADIOACTIVITY AND CONTROL IN THE PETROLEUM INDUSTRY. Gérard Balayre. Ind. Pétrole, 29: 71-2(Sept. 1961).

The problem of regulating the transfer of stored liquids was solved by adding radioactive tracers, such as Co^{60} or Cs^{137}, at a certain point to the petroleum flow. The radiation from the tracers and its subsequent detection were used to control the liquid flow. (OID)

24058 THE EXAMINATION OF WELDED JOINTS OF STEEL PLATES LESS THAN FIFTY MILLIMETERS THICK. Ingeniería Quimíca, 6: 23-6(Jan. 1961).

Hints for applying x and γ rays in order to obtain the best results when examining welded joints are given. The most important factors to be considered are the clearness of the photographical image and the visibility of defects

which is much better with x- than γ-ray exposure. γ-emitting radioisotopes are most effective for welded parts which are located in inaccessible places. In all cases, adequate radiation protection for the workers, according to international rules, should be assured. The approximate location of the welding seam should be indicated on the radiograph by placing lead letters on the place where a possible flaw is suspected. These letters also serve for identifying the radiogram. Of great importance for obtaining good pictures are the proper selection of photographic films; direction of radiation; prevention of secondary radiation by reflected γ rays; observation of the correct distance between the radiation source and film; choice of the correct radiation source, namely, Ir^{192}, Cs^{137}, and Co^{60} for 19-, 25-, and 38-mm thick steel plates, respectively. The quality of the picture can be determined by using a series of 50-mm long steel wires having diameters which increase from 0.100 to 1.000 mm. (OID)

24059 PRESERVATION OF POTATOES AND VEGETABLES BY IONIZING RADIATION. J. Herrmann (Humboldt-Universität, Berlin). Isotopentechnik, 2: 23-9(Feb. 1962). (In German)

The results of studies on the preservation of food materials, particularly potatoes, with 10-kr gamma radiation from Co^{60} are reported. (tr-auth)

24060 THE APPLICATION OF RADIOISOTOPES FOR ON-SITE INSPECTION OF THE STATE OF FRENCH GAS-MAINS. Pierre Ruault. Microtecnic, 16: 259-64(Dec. 1961).

The welds are inspected by using pinpoint sources of Co^{60}, Cs^{137}, Ir^{192}, or Tm^{170} depending upon the thickness of the pipeline walls. Cracks and other defects can be detected by using the lowest energy source suitable for the specific thickness and overexposing the high sensitive film. Fast inspections of large sections of pipelines (up to 1200 m) can be made by moving the radiation source in a carriage inside the pipeline on a traction cable attached to a piston operated by compressed air. The inside of the pipeline becomes covered with dust or other deposits or corroded by condensation of chemically active material, and since it must withstand great pressure, it has to be cleaned regularly with the scraper piston and checked for corrosion. The progress of the scraper can be followed, and the corrosion can be detected by equipping the scraper with a radiation source (preferably Co^{60} or Ir^{192}) and measuring the γ-ray attenuation by moving a Geiger counter outside the pipeline and parallel to the scraper. The main system, which includes branches and meter stations equipped with gas valves, can also be checked for the presence of foreign bodies or leaks. Mathematical calculations and instructions for obtaining optimum results with radioisotopes are appended. (OID)

24061 EXPERIENCES GAINED FROM THE APPLICATION OF γ-RADIATION IN THE FOOD INDUSTRY. Marta Blau, J. Brank, and E. Nemec. Nova Proizvodnja, 11: 259-64(1960).

Research during the last 3 yr on the effects of γ rays on different food articles have given certain results as to the application of γ rays in preserving foodstuffs. Irradiation of pork and poultry by 10^5 to 2×10^5 rep in combination with the preparation of Na-glutamete (0.5% solution) stored at 1-3°C gave very good results. Veal stored under the same conditions can also be preserved for a longer time without spoiling. The quality of meat preserved in this way remains the same for 3 to 6 weeks. Results from irradiated beef, frankfurt sausages and liver pie were satisfactory. Trouty irradiated by 10^6 rep can be kept fresh for 20 days if it is stored in the ice at 1 to 2°C. Depending to the kind of vegetables, doses of 5×10^4 to 3×10^5 rep were applied from which a different storage time was obtained. Tomatoes, green cayenne pepper, French beans, parsley, cauliflower, peas with and without pods, spinach, cucumbers, and carrots can be preserved when stored at 1 to 2°C. Experiments with sugar beets showed that irradiation with 3×10^3 to 15×10^3 rep prevented the development of the infection centers and kept the sugar content on the initial level for several months. (OID)

24062 THE DETECTION OF CABLE DEFECTS BY MEANS OF RADIOISOTOPES. G. Lemm and W. Reusse. NTZ-Nachrtech. Z., 14: 225-6(May 1961).

Co^{60} and Cs^{137} were used to determine the defects in telephone cables. The arrangements are illustrated and discussed. (OID)

24063 PROBLEMS INVOLVED WITH A γ-RAY LEVEL CONTROL SYSTEM IN A HIGH CONCENTRATION BLEACHING TOWER. C. Hibino. Parupu Kami Kôgyô Zasshi, 15: 231-5; 267(Apr. 1961).

An up-flow type pulp bleaching tower is equipped with a γ-ray level control system using a 20-mc Co^{60} source. The level control system is installed at the top of the feed pipe, which is connected to the tower. The pipe is 75 cm in diam, and the counter is located above the source level and on the opposite side of the pipe from the source. The angle projected from the source level to the counter is 45°. The effective level control range is 0.4 to 0.5 m. An adequate adjustment must be provided for the decay of the Co^{60} source. The control problems of the servomechanism are discussed. (OID)

24064 THE PRODUCTION OF PLEXIGLASS (METHYL METHACRYLATE POLYMER) IN SICILY IN A CAPACITY OF 50,000 kg PER MONTH BY RADIOPOLYMERIZATION. Otto F. Joklik. Petrol. e nuove energie, 14: 825-38(Dec. 1960).

A proposition is presented for establishing in Sicily a Plexiglas factory using Co^{60} γ radiation to initiate polymerization of methyl methacrylate which can be obtained quite inexpensively from the methane contained in the large natural gas resources of Italy. Starting with methane, hydrocyanic acid and acetone can be synthesized which react to form acetone-cyanhydrine: Hydrolysis of this compound with sulfuric acid and esterification of the obtained methacrylic acid with methanol lead to the desired monomer methyl methacrylate which is polymerized by γ radiation in the presence of catalyzators, plastifiers, and, if a certain color effect is desired, by pigments. The reaction mechanism of radio-polymerization is based upon the formation of free radicals which form the chain of reacting monomers. The great advantage of this polymerization process is that it can be carried out at low temperatures, unwanted side reactions are eliminated, and the final product has a more uniform consistency. It is proposed that a Co^{60} bar of many kilocuries be used as the source of γ radiation. (OID)

24065 THE APPLICATION OF β-RAY BACKSCATTERING FOR THE CONTROL OF OINTMENTS AND PASTES CONTAINING LEAD OR ZINC OXIDE. M. Šaršúnová and J. Tolgyessy. Pharmazie, 16: 254-5(May 1961).

The various gravimetric and volumetric methods for determining Pb and Zn in various ointments, salves, pastes, and similar preparations, as specified in the pharmacopoeias of various countries, are extremely cumbersome and inaccurate. Attempts to develop a radiometrical method for determining ZnO by using Zn^{65} were successful, but in order to make the analysis the sample had to be destroyed. Therefore, an analytical method was devised

which was nondestructive, fast, and exact. This method utilized the measurement of β-ray backscattering emitted by Tl^{204} through sufficiently thick layers of the preparation under investigation. For this purpose, a measuring apparatus was devised which contained the β emitter, the shallow trough containing the sample, and a Geiger counter which was shielded completely against direct β radiation and only affected by the backscattered radiation. In order to evaluate the test results, calibration curves were drawn for Pb and Zn giving the percentage content of the metals in the ointment as a function of the backscattering percentage. The backscattering intensity was measured up to a value of 4 to 5000 pulses/min. The results indicated that this nondestructive analysis method is more exact than customary methods of analysis. (OID)

24066 UP-TO-DATE METHODS OF DEFECTOSCOPY. V. S. Sokolov. Priborostroenie, No. 9, 16-20(Sept. 1961).

Up to the present time, Co^{60} has been the chief radioisotope used for industrial purposes. Recently, Cs^{137}, Ir^{192}, and Tm^{170} have been used widely. In addition, tests have been carried out with $Eu^{152-154}$, Se^{75}, Sr^{90}, etc. Sr^{90} emits β particles which can be retarded in materials, such as Pb, U, etc., in order to produce wide energy spectrum x rays having a maximum in the region of 100 kev for x-raying thin-walled samples. (OID)

24067 THE APPLICATION OF RADIOISOTOPES IN SHIPBUILDING FOR NONDESTRUCTIVE MATERIAL TESTING. H. Gerlach. Schiffbautechnik, 12: 79-83(Feb. 1962).

Safety and reliability in shipbuilding require exact testing methods for all materials, such as plates, sheets, rods, cast pieces, welded joints, etc. Non-visible defects in parts exposed to great stress may cause great damages. Since both x-ray and γ radiography can detect these defects, a choice has to be made between these radiation sources. In general, for very thick pieces, γ emitters, such as Co^{60} or Ta^{182} are used; for medium thick pieces, γ emitters, such as Ir^{192} or Cs^{137} are used; for very thin pieces weak γ emitters, such as Eu^{155} or x rays are used. There is no competition between x rays and γ rays in nondestructive testing because both methods supplement each other. The technical and economical advantages and disadvantages of both methods are discussed. In shipbuilding, Ir^{192} has extremely good irradiation qualities for sheets from 6 to 50 mm thick and is superior to the x-ray method for checking welds of sheets of this thickness. However, for materials thicker than 50 mm x rays are useless, and defects in this material must be located with hard γ emitters, such as Co^{60}. Recently, mobile test stations with radioisotopes were established which are of great value for checking and quality control in shipbuilding at the shipyard. (OID)

24068 STUDY ON WEAR IN THE SHEARING PROCESS BY MEANS OF IRRADIATED TOOLS. Toshio Sata, Kunio Abe, and Kiyoshi Nakajima. Sci. Papers Inst. Phys. Chem. Research (Tokyo), 54: 307-12(Sept. 1960).

Shearing of sheet metal is one of the most important forms of metal processing and, therefore, the duration of tool life is of great economic importance. Older methods to determine life and performance of tools were inaccurate and time consuming. Therefore, radioactive tools were used in a series of investigations in which the die and punch were bombarded by a neutron flux of $10^{11} n/cm^2/sec$ in an atomic pile for 5 hr. The radioisotopes formed in high speed steel were $Fe^{55,59}$, $W^{181,185,187}$, $Cr^{51,55}$, V^{52}, C^{14}, and Mn^{56}. In shearing tests carried out 24 hr after activation, the radioactivity of the punch was 0.81 mc/g and that of the die 4.4 mc/g. The radioactivity of the punched sheets and punched disks was measured separately with Geiger counters and their intensity observed as a function of 2400 punchings (conventional methods of wear determination require 50,000 punchings to obtain the same degree of accuracy). It was found that lubrication has a great effect upon prolongation of tool life. It was also shown that the wear of both punch and die decreased significantly with decreasing tool clearance. As far as the effect of composition of sheet metal is concerned, it was found that tool wear in punching stainless steel is 3 times, in silicic steel 6 times as large as that of low carbon steel. (OID)

24069 THE APPLICATION OF RADIOISOTOPES. Jean Loeb. Tech. pétrole, 16: 8555-7(Dec. 1961).

No industry has stronger tendencies toward automatic control; therefore, radioisotopes, which made this control possible, are of special importance for the petroleum industry. Radioisotopes can be used to measure inaccessible levels of fluids in containers with an accuracy of $\pm 0.1\%$ and control automatically. The density of circulating liquids can be measured with a precision of $\pm 0.1\%$, and nondestructive tests by remote control of machine parts, etc., can be made. All of these measurements are based on the attenuation principle according to which the radiation intensity is decreased by the material through which it passes. Mathematical calculations are given for liquids in circulation. Various types of radiation, different radiation sources, and detectors for nuclear radiation (with only ionization chambers and Geiger counters having the necessary equipment for remote control) are discussed. Statistical problems, especially the well-known relationship, $\sigma = \sqrt{N}$, where σ is the standard deviation and N the number of counts, are discussed. Although density measuring instruments are complex, level gages are relatively simple because a specific quality does not have to be determined exactly, but only whether or not the radiation passes through the liquid. (OID)

24070 THE EFFECTS OF γ-IRRADIATION ON THE QUALITY AND STORAGE OF FISH. Keishi Amano and Kinjiro Yamada. Tokaiku Suisan Kenkyusho Kenkyū Hokōku, No. 26, 51-9(Nov. 1959).

The effect of γ irradiation from a 400-c Co^{60} source on the quality and length of shelf life for 22 species of fish was examined. The samples were irradiated at room temperature for 20 hr to a dosage of approximately 10^6 rep. After irradiation, the samples were stored in a refrigerator at temperatures between 2 and 4°C. Results showed that the translucency characteristic of raw muscle tissue of fresh flat fish was lost by irradiation and the surface of the flesh turned into chalky yellow; this change was not observed in octopus, clams, oysters, squid, and abalone. The blood-red flesh of tuna changed to greenish-brown on irradiation. Rancid odor, browning of flesh, and off-flavor became evident when irradiated fish was cooked. The irradiated raw samples appeared firmer than the control samples, but no appreciable difference in firmness was noted after cooking. (OID)

24071 STUDIES ON THE BROWNING OF IRRADIATED FISH. I. THE EFFECT OF THE PRESENCE OF FREE SUGAR ON THE BROWNING OF FISH FLESH. Kinjiro Yamada and Keishi Amano. Tokaiku Suisan Kenkyusho Kenkyū Hokōku, No. 27, 47-53(Feb. 1960).

Tabular data are shown for the oil content (0.2 to 7.7%) and corresponding browning of 22 species of Co^{60} γ-irradiated fish flesh; the development of browning of squid treated with ether and acetone prior to irradiation during a storage period at −7 to 8°C for 7 days and then 0 to 4.5°C; the absorption coefficient of an irradiated sugar solution at

270 mμ, yellow discoloration of the sugar solution by heating subsequent to irradiation, and the reflectance (40 to cliff) of sugar on radiation-induced browning of cooled fish; and pH values on the maximum absorption band and the intensity of the irradiated sugar solution, on yellow discoloration of the sugar solution by heating subsequent to γ irradiation up to 2000 kr, and on the radiation-induced browning of cooked fish flesh. It is suggested that rancidity might be the cause of discoloration because the discoloration was not affected by the presence of various sugars or intensified by an increase in the pH values. (OID)

24072 RADIOACTIVE TRACERS IN CHEMISTRY AND INDUSTRY. Pascaline Daudel. Translated from the French by Ulli Eisner. London, Charles Griffin, 1960. 210p.

This English version is a newly revised and enlarged edition of "la radioactivité au service de la chimie et de l'industrie," first published in 1955. The book describes the use of radioactive tracers in chemistry and industry. Chapter 1 deals with the preparation and extraction of radioelements, the synthesis of labeled compounds, and radiation detection and measurement. Chapter 2 deals with the application of tracer techniques to the study of reaction mechanisms, and chapter 3 discusses exchange reactions (Walden inversion, first and second order homogeneous phase reaction, etc.). Chapter 4 is devoted to the use of tracer techniques in chemical analysis, while chapter 5 presents industrial applications of radioactive tracers: resistance of materials (friction, corrosion, deterioration), metallurgy(assay and distribution of constituents of an alloy, diffusion in metals, equilibria, origin of impurities), electrochemistry, petroleum industry, polymerization, prints, dyeing, cosmetics, glass, water industry, agriculture, public health and safety. Each chapter is followed by an extensive bibliography. An appendix contains a table of the principal radioisotopes and describes experimental procedures for (1) exchange reactions, (2) radiomicrosynthesis, (3) study of a chemical reaction and determination of a molecular structure, and (4) separation of radiosodium and radiopotassium by means of ion-exchange chromatography. (OID)

24073 RADIOISOTOPES. Olga Jovanović-Kovacević. Belgrade, Export Press, 1960. 45p.

This book presents in simple language the theory of the atom and the atomic nucleus and explains the nuclear reactions which lead to the formation of radioisotopes. Nuclear reactor design, processes in the production and separation of radioisotopes, as well as their applications in industry, medicine, and the natural sciences, and agriculture are also discussed. (OID)

24074 WHAT ISOTOPES OFFER US. A. Milojević, V. Urosević, and M. Kurepa. Belgrade, Export Press, 1960. 64p.

Chapters are included on (1) radioisotopes and their practical applications; (2) production of radioisotopes and principles of application; (3) control and automation of the production processes; (4) initiating chemical reactions by radiation; (5) change of physical properties; (6) biological effects of radiation; (7) radioisotopes as tracers; (8) use of tracers in agriculture and medicine; (9) fundamentals of protection against radiation; and (10) Yugoslav centers using radioisotopes. (OID)

24075 THE RADIOISOTOPE IODINE-I^{131}. L. S. Kozyreva-Aleksandrova and N. I. Temmikova. Moscow, Atomizdat, 1960. 21p.

The theory of radioisotopes as developed in this century is reviewed. Discussions are included on (1) chemical methods for extracting I^{131}, (2) extracting I^{131} with the carrier from irradiated Te, (3) methods of extracting carrier-free I^{131}, (4) extracting I^{131} from neutron-irradiated Te, (5) applications of I^{131}, and (6) safety engineering and techniques to be used while working with radioactive iodine. (OID)

24076 THE RADIOSULFUR ISOTOPE S^{35}. V. A. Sokolov, E. A. Tikhomirova, and N. A. Kosolapova. Moscow, Atomizdat, 1960. 25p.

Sections are included on (1) physical properties and methods of obtaining S^{35}; (2) production of preparations containing S^{35}; (3) uses of S^{35}; and (4) safety techniques to be used when working with S^{35}. (OID)

24077 AUTOMATION OF TECHNOLOGICAL PROCESSES IN THE PULP AND PAPER INDUSTRY. M. S. Voroshilov and E. Ya. Balasov. Moscow, Goslesbumizdat, 1960. 470p.

This book presents the basic technological processes used in pulp and paper making, automation circuits, etc. In chapter 13, the use of radioisotopes in the automation of technological processes is discussed. Sections are included on information on nuclear physics; prospects for using radioactive emissions for the automation of the measurement and control of parameters in the pulp and paper industry; automatic measurement of the weight of 1 sq m of paper sheet; and instruments for measuring the level and density of liquids. (OID)

ISOTOPE SEPARATION

Refer also to abstract 24075.

24078 INFLUENCE OF TEMPERATURE ON THE ELECTROLYTIC SEPARATION FACTOR OF HYDROGEN ISOTOPES. L. P. Roy (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem., 40: 1452-60(July 1962).

An electrolysis cell and a tritium counting system are described for the study of the influence of temperature on the electrolytic separation of hydrogen isotopes on a mild steel cathode in alkaline solution. By careful control of the conditions for electrolysis, the separation factors could be determined with a probable error of ±4%. From the temperature coefficients of the three separation factors, α, β, and γ, differences in activation energy of –1680, –2260, and –580 cal/mole were calculated for electrolysis in the H-D, H-T, and D-T systems respectively. When conditions were less stringently controlled, the separation factor β was found to be a linear function of the separation factor α according to an equation of the form $\beta = D\alpha - E$. This relationship is of importance in the use of deuterium as a tracer in the electrolytic concentration of natural tritium. Some empirical equations showing the temperature influence on the variation of β as a function of α are also included. (auth)

24079 REACTIONS WITH N^{15}. XXXVII. SEPARATION EFFECTS BETWEEN THE ISOTOPES N^{14} AND N^{15} DURING THE PRODUCTION OF WATER-FREE NITRIC ACID BY THE DIRECT METHOD. K. Clusius and H. J. Poschet (Universität Zürich). Helv. Chim. Acta, 45: 1-4(1962). (In Swedish)

In an installation for the production of highly concentrated nitric acid by the direct method, enrichments of the N^{15} concentrations from the natural value 0.365% up to 0.388%, that is, about 6.3%, occur. In the final product, an acid with 98.7% HNO_3, an impoverishment of 0.358% occurs, which can be traced back to the withdrawal of aqueous acid with increased N^{15} concentration during the preparation. (tr-auth)

24080 THE PRODUCTION OF CARRIER-FREE RADIOISOTOPES. II. FUNDAMENTAL PRINCIPLES. Lajos Imre. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 7: 1-21(1959).

The thermodynamics and kinetics of the adsorption process are discussed with the purpose of utilizing the known principles governing adsorption for producing carrier-free radioisotopes. This theoretical knowledge can be used partly, directly for producing isotopes by adsorption methods and partly, indirectly for determining the rate of reaction in electrolytic processes. A new viewpoint is introduced into thermodynamical considerations by showing the possibility of applying methods of statistical mechanics for the calculation of the free enthalpy of the interfacial intermediary layer and comparing the results obtained with those of Gibbs' classical thermodynamics. The synthesis of the above two methods led to the recognition that adsorption may be distinguished from ion exchange processes methodically, and the properties of adsorptive isotopes can be recognized also in carrier-free substances. Throughout the whole electrolysis of carrier-free radioisotopes, the kinetics were followed taking into account especially the asymmetrical electrode systems which proved to be very advantageous in production and improving the working conditions. (OID)

24081 THE PRODUCTION OF CARRIER-FREE RADIOISOTOPES. III. MODEL EXPERIMENTS FOR PRODUCING CARRIER-FREE AND HIGH SPECIFIC ACTIVITY Fe^{59}. Ferenc Molnár. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 7: 22-8 (1959).

Anion exchange separation of Fe(III) and Co(II) was studied in a hydrochloric medium. It was found that micro quantities of Fe(III) can be separated from both micro- and macro-quantities of Co(II) by applying an anion exchange resin. By this method, high-specific activity Fe^{59} can be produced. Further experiments are required to prove whether it is suitable for the preparation of carrier-free samples. (OID)

24082 THE PRODUCTION OF CARRIER-FREE RADIOISOTOPES. IV. MODEL EXPERIMENTS FOR PRODUCING CARRIER-FREE S^{35}. Ferenc Molnár. Magyar Tudományos Akad. Kozponti Fiz. Kutató Intézetének Közleményei, 7: 29-36(1959).

$FeCl_3$ was used as target material in these experiments. The possible chemical yield of S^{35} and the removal of P^{32} from the system were studied, and the experimental techniques are described. (OID)

24083 THE PRODUCTION OF CARRIER-FREE RADIOISOTOPES. V. THE ELECTROLYTIC METHOD. József Molnár. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 7: 37-44(1959).

The electrolytic separation of Cu^{64}, Po^{210}, and Ag^{111} from the suitable target materials was studied. In the electrochemical procedures, the asymmetric electrode system suggested by L. Imre was used and techniques for the production of carrier-free Cu^{64} and Ag^{111} were developed. (OID)

24084 THE PRODUCTION OF CARRIER-FREE RADIOISOTOPES. VI. THE METHOD OF SOLID SOLUTIONS. Béla Tóth. Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közleményei, 7: 45-58(1959).

Fundamental research was carried out in order to produce carrier-free Ba^{140}, Sr^{89}, and Sr^{90}. The results obtained from the study of statistical thermodynamics in solid solutions are given. (OID)

24085 THE PRODUCTION OF CARRIER-FREE RADIOISOTOPES. VII. THE ADSORPTION OF I^{131} ON Pt ELECTRODE SURFACES. Géza Tóth. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 7: 59-66(1959).

The adsorption of carrier-free I^{131} isotopes on Pt surfaces and their electrolytic deposition were studied. These experiments were carried out to develop a procedure for producing I^{131} and I^{132} from fission products without the drawbacks of the distillation method, i.e., relatively small yield, frequent sulfate impurities, and low specific activity/unit volume, and to study the mechanisms of the adsorption and the electrolytic deposition of carrier-free radioactive iodine. An attempt is made on the basis of the experimental results to interpret theoretically the apparent divergencies in the electrochemical behavior of microscopic and macroscopic quantities of iodine. (OID)

MATHEMATICS AND COMPUTERS

Refer also to abstract 24652.

24086 (ARL-229) RATIONAL APPROXIMATION OF DECAY-TYPE FUNCTIONS. Technical Note No. 66. Klaus Appel (Uppsala Univ.). Oct. 1, 1961. Contract AF 61(052)-351. 16p. (AD-271370)

A computer program is described for least-squares or best-fit rational approximation of numerical decay-type functions. (auth)

24087 (BNL-725) A COMPUTER LEARNS TO SEE. Paul V. C. Hough (Brookhaven National Lab., Upton, N. Y.). Feb. 14, 1962. Contract [AT(30-2)-Gen-16]. 14p. Brookhaven Lecture Series No. 14.

Information is presented from a lecture on computers. Included are discussions concerning computers and human values, computer operation, and problems at the threshold of computer capability. A more detailed discussion is included concerning a computer in relation to the problem of bubble chamber data analysis. (J.R.D.)

24088 (GA-2451(Vol.II)) NUCLEAR DATA FOR GAM-I DATA TAPE. VOLUME II. G. D. Joanou, J. S. Dudek, A. J. Goodjohn, N. F. Wikner, and J. D. Garrison (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Aug. 22, 1961. Contract AT(04-3)-314. 243p.

Nuclear data for GAM-I data tape are presented for 43 nuclides. (J.R.D.)

24089 (GEMP-114) PROGRAM 20-3, A PROGRAM FOR COMPUTATION OF TOTAL MACROSCOPIC CROSS SECTION AND COLLISION PROBABILITIES FOR SPECIFIED MATERIAL COMPOSITION. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962. Contract AT(40-1)-2847. 26p.

Auxiliary nuclear data program 20-3, GE-NMPO program 482, is a digital computer program that calculates the total macroscopic cross section for a specified material composition. Output from the program is available on punched cards suitable for input to Monte Carlo program 18-0. A printed listing of output is also prepared by the program. Program 20-3 is coded for use on an IBM 7090 having 32,768 magnetic core memory locations. (auth)

24090 (GEMP-116) PROGRAM 20-5—A PROGRAM FOR PREPARATION OF SPECTRUM TABLES FROM EVAPORATION MODEL. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962. Contract AT(40-1)-2847. 26p.

Auxiliary nuclear data program 20-5, GE-NMPO program 484, is a digital computer program that utilizes the evaporation model of nuclear reactions to determine cumulative probability tables for energy spectra of inelastically scattered neutrons. Output from the program is available on punched cards suitable for input to Monte Carlo programs 18-0 and FMC-N. A printed listing of output is also prepared by the program. Program 20-5 is coded for use on an IBM 7090 having 32,768 magnetic core storage locations. (auth)

24091 (GEMP-117) PROGRAM 20-6, A PROGRAM FOR COMPUTING NUCLEAR EXCITATION AND TRANSITION PROBABILITIES FROM MEASURED GAMMA RAY INTENSITIES. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962. Contract AT(40-1)-2847. 22p.

Auxiliary nuclear data program 20-6, GE-NMPO program 485, is a digital computer program that computes excitation and transition probabilities for excited states of the residual nucleus from an (n,n') inelastic scattering reaction, given the relative intensities of the various transitions that occur in the process. Program 20-6 is coded for use on an IBM 7090 having 32,768 magnetic core storage locations. (auth)

24092 (IDO-16735) MUFT REVISION—A FAST NEUTRON SPECTRUM CODE FOR THE IBM-650. R. A. Grimesey, F. E. Mullin, and L. J. Gannon (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Mar. 1, 1962. Contract AT(10-1)-205. 49p.

The MUFT-R program for the IBM-650 is a revised version of MUFT-III designed to solve the fast neutron transport problem for general mixtures of elements and obtain sets of average fast neutron diffusion constants for specified portions of the fast energy spectrum. Because the MUFT equations involve many approximations to the exact transport model, a detailed derivation of the equations is included. The Goertzel-Greuling approximation for deuterium was incorporated into the equations so that deuterium moderation may be treated accurately. Machine operation was simplified and a unified input and output format make the program easy to use. (auth)

24093 (KAPL-M-RPC-4) MINK (MUFT-KATE INTO KARE). A. L. Liedel (Knolls Atomic Power Lab., Schenectady, N. Y.). Apr. 1962. Contract W-31-109-eng-52. 14p.

MINK is a service routine designed to automate the transcription of MUFT and KATE output data to KARE input cards. MUFT and KATE problems are run as a part of "MINK System Run," which terminates in a MINK job. Users must supply buckling values, number of gross regions, and number of groups as MINK input. MINK output cards are punched in KARE pre-calculated cross section format to be inserted directly into the KARE input deck. The time required to run MINK, exclusive of time for MUFT and KATE problems, is approximately four seconds per gross region. (auth)

24094 (MND-C-2500-6) A PROGRAM AND CROSS-SECTION LIBRARY TAPE SYSTEM FOR THE ARMY PRESSURIZED WATER REACTOR CODE. T. M. Olsen (Martin Co. Nuclear Div., Baltimore). June 1962. Contract [AT(30-1)-2431]. 91p.

A system of IBM 7090 FORTRAN-II and FAP subroutines for preparing program and cross-section library tapes is described. These subroutines are intended primarily for use with the Army Pressurized Water Reactor Code (APWRC), but many of their features and advantages make them useful for other codes also, particularly those in the planning stages. The program library subroutines are added to an existing code by means of a single CALL statement. They provide a diagnostic edit for any of the standard FORTRAN-II I/O (input-output) halts and for any logical halts which the programmer cares to include in FORTRAN-II source programs. The same routines also allow any program containing them to be written on a reference library tape without need for further modification. This program library tape is the foundation for the automated APWRC. Channel trapping is used to search for a program on this tape while calculations are proceeding in the central processing unit of the computer. Rapid program access is thus provided without the disadvantage of writing

large decks on a temporary magnetic tape at each application, as with the FORTRAN-II CHAIN function. The subroutines require the first 1700-8 core locations. All necessary information for generating, using, and modifying the three cross section versus energy files required by APWRC is presented. (auth)

24095 (ORNL-TM-229) A FORTRAN PROGRAM FOR CALCULATING SINGLE CRYSTAL ABSORPTION CORRECTIONS. D. J. Wehe, W. R. Busing, and H. A. Levy (Oak Ridge National Lab., Tenn.). Apr. 1962. Contract [W-7405-eng-26]. 44p.

A Fortran program is described for calculating the absorption correction for application to single crystal x ray or neutron intensity measurements. The program is available in the form of symbolic punched cards. Instructions are included. (J.R.D.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

Refer also to abstracts 23373 and 24612.

24096 (DMIC-168) BERYLLIUM FOR STRUCTURAL APPLICATIONS. A REVIEW OF THE UNCLASSIFIED LITERATURE 1958–1960. Webster Hodge (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). May 18, 1962. Contract AF33(616)-7747. 203p.

References (186) on physical and process metallurgy of beryllium are given to books and U. S. and foreign journals and reports published from 1928 to 1960. In addition, reference is also made to some of the more important writings on health hazards and safety procedures. An Appendix with an extensive selection of physical and mechanical property data on beryllium hot-pressed block and on beryllium sheet is included. (P.C.H.)

24097 (EURAEC-57) SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. (France. Commissariat à l'Energie Atomique, Paris). Apr. 1961. Work performed under United States–Euratom Joint Research and Development Program Contract 031-60-10RDF. 91p.

Sintering methods, testing of sintered products, and behavior under irradiation are discussed. Separate abstracts were prepared for 9 of 10 technical appendixes. (M.C.G.)

24098 (EURAEC-57(App.1)) PREPARATION OF UO_2 IN POWDER ROOM. P. Chenebault [(Compagnie Générale de Télégraphie sans Fil, Paris)]. Appendix 1 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. p.6-17.

The preparation of UO_2 powders for sintering by reduction of UO_3 is described. It was necessary to use preliminarily roasted trioxides in order to develop their specific area. It was found that the partial hydrogen pressure in the reducing gas must not be too high. Satisfactory reproducibility of the results was not obtained. (M.C.G.)

24099 (EURAEC-57(App.2)) URANIUM DIOXIDE SHAPING. (Compagnie Industrielle des Combustibles Atomiques Frittés, Corbeville, par Orsay (Seine-et-Oise), France). Appendix 2 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. p.18-47.

Shaping and sintering tests were carried out on UO_2 powders compressed by means of a mechanical press at 1400, 1500, and 1650°C in an atmosphere of cracked ammonia. The mechanical press was found to be inadequate. The effects on pressing and sintering of the type of binder, method of lubrication, method of graining, and compacting pressure were determined. The various tests revealed the importance of powder granulation and a fairly unsatisfactory reproducibility of wet process treatments. (M.C.G.)

24100 (EURAEC-57(App.3)) URANIUM OXIDE SINTERING FURNACE. DESCRIPTION OF THE FURNACE—PROGRESS REPORT ON THE WORK AND THE STUDY. B. Aubry [(Compagnie Générale de Télégraphie sans Fil, Paris)]. Appendix 3 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. p.48-52.

The design of the uranium oxide sintering furnace is described. Tests carried out on refractors, insulating materials, and heating elements are discussed. (M.C.G.)

24101 (EURAEC-57(App.4)) PREPARATION OF URANIUM DIOXIDE POWDER FOR FIAT (TURIN). P. Chenebault (Compagnie Generale de Telegraphie sans Fil, Paris). Appendix 4 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. p.53-4.

Ten kilograms of small area powder were sent to Italy. This powder was sintered after standard shaping. A photograph is presented showing porosity distribution. (M.C.G.)

24102 (EURAEC-57(App.5)) LABORATORY STUDY ON THE USE OF WET HYDROGEN AS SINTERING ATMOSPHERE. B. François [(Compagnie Générale de Télégraphie sans Fil, Paris)]. Appendix 5 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. p.55-64.

The use of wet hydrogen as sintering atmosphere will be studied in a continuous operation furnace which makes it possible to use widely different sintering cycles. This furnace consists mainly of a laboratory tube in airtight sintered alumina. A device for humidifying gas at a constant rate is being built. The mobile assembly for transport of samples was modified. Diagrams are included. (M.C.G.)

24103 (EURAEC-57(App.6)) RESISTANCE TO THERMAL SHOCK. M. Brandela [(Compagnie Générale de Télégraphie sans Fil, Paris)]. Appendix 6 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter, 1961. p.65-9.

The resistance of UO_2 pellets and extruded cylinders to thermal shock was investigated. The resistance to thermal shock of extruded and sintered UO_2 appeared to be inferior to that of compressed and sintered UO_2. It was found that the measurement of resistance to thermal shock could be expressed, not by a number of cycles at an arbitrarily fixed temperature, but by a temperature threshold beyond which cracks appear in the sample. (M.C.G.)

24104 (EURAEC-57(App.7)) MEASUREMENT OF THERMAL CONDUCTIBILITY BY RADIAL FLOW. J. P. Hairion [(Compagnie Générale de Télégraphie sans Fil, Paris)]. Appendix 7 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter, 1961. p.70-3.

Preparation of UO_2 samples for measurement of thermal conductivity by radial flow is discussed. Tests of shaping UO_2 powder around a metallic wire and sintering showed that the differences in elongation coefficients caused the cylinders to break. It was therefore decided not to encase tungsten wire in UO_2, but to stretch it in the center hole of an oxide cylinder. The same principle of measurement will still be applicable. (M.C.G.)

24105 (EURAEC-57(App.8)) UO_2 SINTERINGS PRELIMINARY TO IRRADIATIONS IN EL3. G. Detiffe [(Com-

pagnie Générale de Télégraphic sans Fil, Paris)]. Appendix 8 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter, 1961. p.74-83.

UO_2 homogenized by wet grinding and granulated was shaped at pressures from 0.5 to 6.5 t/cm^2. It was possible to achieve the required densities by variation of sintering times and temperatures. It was found that if it is desired to limit the shaping pressure between 1 and 6 t/cm^2 in order to obtain sintered densities of 10.2, 10.4, and 10.6, it is necessary to sinter in hydrogen at 1500°C for 3 hr. (M.C.G.)

24106 (EURAEC-57(App.9)) BENCH LOOP FOR THE STUDY OF PRE-IRRADIATED SAMPLES. A. Schuerenkaemper and A. Tachis [(Compagnie Générale de Telegraphie sans Fil, Paris). Appendix 9 of SINTERED URANIUM OXIDE: SINTERING TECHNIQUE AND BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 2, First Quarter 1961. p.84-6.

A loop for study of pre-irradiated samples is being assembled. The vacuum system, diffusion furnace, and gas circulation pump are described. Two methods for measurement of fission gases were developed. (M.C.G.)

24107 (GEAP-3831) INVESTIGATION OF B_4C–Ni ELECTRO DISPERSIONS FOR CONTROL ROD APPLICATIONS. H. E. Williamson, D. L. Zimmerman; and K. C. Antony (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Nov. 3, 1961. Contract AT(04-3)-189. 40p.

Preliminary investigations of the thermal and radiation stability and high temperature water corrosion resistance of small samples of a potential control rod material, B_4C dispersed in nickel electrolytically co-deposited on a stainless steel base, are reported. No chemical reaction between B_4C and Ni was detected at 375°C within 800 hours. Radiation damage does not appear to be a limitation to performance except for a volume increase of about 10%, at exposures up to 94% B^{10} burn-up (86 days). The volume change increased to 10 to 20% and some small blisters began to appear on part of the samples after 95% B^{10} burn-up (138 days). The presence of B_4C particles did not appear to impair the corrosion resistance of the matrix nickel in high temperature (546°F, 1000 psi) steam and water. The results were encouraging and work was extended to the development of a prototype control rod for operation in Vallecitos Boiling Water Reactor. (auth)

24108 (IS-351) ANNUAL SUMMARY RESEARCH REPORT IN METALLURGY, JULY 1960–JUNE 1961. (Ames Lab., Ames, Iowa). Dec. 1961. Contract W-7405-Eng-82. 147p.

Research progress on metallurgy is reported. Topics covered include: metal preparation and purification studies, phase equilibria and thermodynamic properties of alloys, physical and mechanical properties of metals and alloys, solid-state investigations, separation studies, and other investigations. (M.C.G.)

24109 (LA-2666) PLUTONIUM ELECTROREFINING. L. J. Mullins, J. A. Leary, A. N. Morgan, and W. J. Maraman (Los Alamos Scientific Lab., N. Mex.). Feb. 2, 1962. Contract W-7405-eng-36. 70p.

Extends report LAMS-2441.

Electrorefining processes were developed for the preparation of high purity, high density plutonium metal on the 500 g and 3.5 kg scales. Equipment, procedures, and results are discussed. A preliminary cost analysis for the recycle of plutonium scrap indicates that electrorefining is considerably cheaper than conventional aqueous methods. Data are tabulated. (auth)

24110 (MAB-139-M(C4)) STATE OF THE ART ON POWDER METALLURGY. Fourth Progress Report by the Panel on Casting and Powder Metallurgy. (National Research Council. Materials Advisory Board). May 28, 1962. 48p.

The processes for the consolidation of powders and their subsequent sintering and post-treatments are reviewed. Processes needing improvement for powders of beryllium and refractory metals and alloys include rolling thin wide sheet of varying densities or permeabilities, sintering modifications to enable lower temperature or shorter times for refractory metals, and the introduction of composites having desired properties of high strength low weight through the use of whiskers or high-strength fibers. (auth)

24111 (NP-11825) DEFENSE METALS INFORMATION CENTER SELECTED ACCESSIONS. Virginia L. Frazier, comp. (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). May 1962. 58p.

Ninety-eight references on high-strength alloys, light metals, nonmetallics, refractory metals, and coatings, applications, and composites are given to reports, journals, and conference papers published from November 1961 to April 1962. Separate author, subject, and DMIC numerical indexes are included. (P.C.H.)

24112 (PLASTEC-NOTE-2) INDEXED REFERENCES PERTAINING TO DEGRADATION AND FRACTURE OF PLASTICS. Arnold E. Molzon (Picatinny Arsenal. Plastics Technical Evaluation Center, Dover, N. J.). Aug. 1961. 37p.

Two hundred and ten selected references pertaining to the degradation and fracture of plastics are presented. These are cross indexed in terms of specific types or classes of plastic materials, and in terms of pertinent subjects such as degradation, failure mechanism, fracture, and stress cracking. (auth)

24113 SOME NEW DEVELOPMENTS IN FUEL ELEMENTS FOR POWER REACTORS. Manfred Becker (Nuklear-Chemie und -Metallurgie G.m.b.H., Wolfgang bei Hanau am Main, Ger.). Atom u. Strom, 2: 9-13(Feb. 1962). (In German)

Developments in the search for simple and economic production of fuel elements for power reactors are summarized. The most important developments lie in the area of uranium powder metallurgy and uranium ceramic fuels. Recent investigations in this field are briefly summarized. (J.S.R.)

24114 CALCIUM. J. F. Smith, comp. (Ames Lab., Ames, Iowa). Metals Handbook, 1: 8th ed., (Jan. 1961). (IS-223)

A brief review is given on the uses, properties, structure, casting, and forming of calcium. 16 references are given. (P.C.H.)

24115 EFFECTS OF HIGH PRESSURES ON MATERIALS. A Bibliography and Data Sheets. H. H. Hausner and H. C. Friedeman (Hausner (Henry H.), New York). [nd]. 28p. $1.00 (Ilikon Corp., Natick, Mass.).

The bibliography on the effects of high pressures on the formation and properties of materials contains 112 references. Several graphs and tables are also presented in order to show a few examples of the effects of high pressures on solids. (N.W.R.)

24116 IMPLICATIONS OF SINTERING THEORIES WITH REGARD TO PROCESS CONTROLS. W. D. Kingery (Massachusetts Inst. of Technology, Cambridge). p.461-71 of "Transactions of the International Ceramic Congress, 7th, London, May 23-28, 1960." Stoke-on-Trent, England, British Ceramic Society, 1961.

In sintering, powder compacts are consolidated into strong, dense products by heating at high temperatures. Changes in compact structure take place under force of surface tension with a rate determined by viscosity, volume-diffusion coefficient, vapor pressure, or surface-diffusion coefficient. In cases where solid and liquid are present together, solution and reprecipitation may be the predominant process. For these cases, theoretical analyses and experimental data are compared. It is shown that for different systems (pottery and fireclay, pure oxides, basic refractories, cermets) different sintering-mechanisms predominate. For these mechanisms semiquantitative relationships are developed which confirm the proposed mechanisms and allow a rational analysis of the process kinetics. When different processes are predominant, variables such as temperature, sintering-time, atmosphere, composition, temperature uniformity, material preparation, and rate of heating, affect results in different ways. Examples illustrate how a theoretical analysis of the problem and an understanding of the kinetics can lead to better control of these process variables; critical variables in processing are indicated for particular applications. (auth)

Corrosion

Refer also to abstracts 24496 and 24622.

24117 (ARF-2198-28) IMPROVED ZIRCONIUM ALLOYS. Quarterly Report, January 1, 1962–March 31, 1962. D. Weinstein and F. C. Holtz (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Apr. 6, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-378. 15p. (EURAEC-347)

Experiments concerned with the development of zirconium-base alloys having corrosion resistance and strength superior to Zircaloy-2 and/or the development of materials of equivalent corrosion resistance but exhibiting enhanced strength are presented. After 3000 hr exposure to 680°F water, binary zirconium alloys showed corrosion resistance superior to Zircaloy-2. Alloys considered promising and which offer the highest chance of success are based on the binary compositions Zr–1Cr, Zr–1Sb, Zr–0.5Nb, and Zr–0.5Sn with small additions of Te, Ge, Cr, or Fe. Alloys containing relatively high percentages of solute elements did not exhibit satisfactory corrosion properties. Corrosion data on experimental alloys in 750°F steam indicate a few highly promising and initially acceptable materials, which are Zr–3Cr–1Fe, Zr–3Cr–0.25Te, and Zr–1V–1Fe. Thus far the corrosion resistance is better than Zircaloy-2 and the higher alloy content indicates enhanced elevated temperature strength. (P.C.H.)

24118 (BMI-X-201) CORROSION ANALYSIS OF ORNL PILOT-PLANT COMPONENTS. P. D. Miller, W. L. Riegelmeyer, W. K. Boyd, and F. W. Fink (Battelle Memorial Inst., Columbus, Ohio). May 15, 1962. Contract [W-7405-Eng-92]. 37p.

Results of a corrosion evaluation of components and corrosion specimens from the Volatility Pilot Plant at ORNL are presented. The extent of the corrosion damage was established by micrometer measurements of dimensional changes and on metallographic studies of sections from typical specimens. (auth)

24119 (GAMD-2221) PROCEDURES FOR THE PREPARATION OF GRAPHITE MATRIX FUEL COMPACTS CONTAINING CARBON COATED $(Th,U)C_2$ FUEL PARTICLES. W. V. Goeddel (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Apr. 27, 1961. Contract AT(04-3)-314. 16p.

Details of fabrication processes for the HTGR fuel compacts are presented. These compacts consist of Th-U dicarbide particles dispersed in a graphite matrix. A 10 wt % pitch binder is used in a warm pressing process to produce a high density matrix of 95 vol % graphite and 5 vol % C. (J.R.D.)

24120 (HW-73211) INHIBITION OF CORROSION OF 304-L IN HNO_3–HF MIXTURES WITH ALUMINUM. W. L. Walker (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 5, 1962. Contract AT(45-1)-1350. 6p.

Data are presented on the aluminum to fluoride ratios necessary to achieve satisfactory inhibition of the corrosion of type 304-L stainless steel in HNO_3–HF mixtures. Stainless steel samples were exposed to boiling solutions containing HNO_3, HF, and $Al(NO_3)_3$ at various concentrations. The data indicate that an aluminum-to-fluoride mole ratio of 5 to 6 is sufficient to produce almost complete inhibition in 0.01 M HF solutions with HNO_3 concentrations up to 10 molar. A mole ratio of 5 to 6 also produced good inhibition in 4 M HNO_3 solutions with HF concentrations up to 0.1 molar. Samples exposed in the vapor phase and at the interface of boiling solutions of aluminum-inhibited HNO_3–HF acid did not exhibit any evidence of accelerated attack. (P.C.H.)

24121 (KR-18) PITTING CORROSION OF ALUMINIUM IN CONTACT WITH STAINLESS STEEL. Ketil Videm (Norway. Institutt for Atomenergi, Kjeller). May 1962. 34p.

Initiation and growth of corrosion pits on aluminum were studied under anodic polarization with a potentiostatic and galvanostatic technique on freely corroding aluminum and on coupons specially made for measuring the current flowing between aluminum and stainless steel in electrical contact. The first step in the development of pitting was a local destruction of the protective oxide film. This lead to so-called micropits, which under proper conditions can develop further into normal pits. The rate of initiation was found to increase rapidly when the corrosion potential exceeded a certain value. The rate of growth was affected by a series of variables and the cathode reaction mainly determined the area of growing pits. Electrical contact with stainless steel increased the corrosion potential of aluminum and in many cases from a value where the corrosion was harmless into a region where initiation and growth of pits were rapid. Pitting will not occur on aluminum coupled to stainless steel if the water is sufficiently pure. However, dissolved corrosion products given off from the aluminum can make water of initial high purity so corrosive that pitting attack results. (auth)

24122 (NP-11700) OXIDATION RESISTANT HIGH TEMPERATURE PROTECTIVE COATINGS FOR TUNGSTEN. Quarterly Progress Report No. 4, February 1, 1962 to April 30, 1962. (TAPCO. Div. of Thompson Ramo Wooldridge Inc., Cleveland). May 15, 1962. Contract AF33(616)-8188. 68p. (TM-3413-67)

High temperature protective characteristics of the W + (Si – W) – O, W + Ti – Zr – (Si – W) – O and W + Ti – (Zr – B) – (Si – W) – O systems were investigated under cyclic conditions in air at 3000 and 3300°F. An outer coating scale or crust layer, formed during the (Si – W) addition to the Ti – Zr and Ti – (Zr – B) coating complexes, was found to be responsible for early coating failures at 3000 and 3300°F. The composition of the outer crust layer and nature of the layer-coating reaction was tentatively

identified. Methods of either preventing formation of the outer crust layer or removing it after formation were investigated with partially successful results. Tensile properties were determined over the temperature range of room temperature to 3200°F for tungsten sheet in the following conditions: as received in vacuum, coated with the W + (Si – W) – O and W + Ti – Zr – (Si – W) – O systems in argon, heat treated (simulated coating treatment) and recrystallized in vacuum, and coated with the W + (Si – W) – O and W + Ti – Zr – (Si – W) – O systems in air. Thermal shock, hot gas erosion, and stress oxidation tests were conducted on the W + (Si – W) – O and W + Ti – Zr – (Si – W) – O systems in air at elevated temperatures. Operation of the high temperature oxidation furnace and oxide complexing furnace is described and performance data discussed. (auth)

24123 (TID-16030) INTERMEDIATE–TEMPERATURE OXIDATION OF BERYLLIDES. Quarterly Progress Report, September 1, 1961–March 1, 1962. Frank C. Perkins (Denver. Univ. Denver Research Inst.). Mar. 8, 1962. Contract AT(11-1)-1092. 32p. (DRI-2031)

Oxidation characteristics of $ZrBe_{13}$, Zr_2Be_{17}, $NbBe_{12}$, and Nb_2Be_{17} were studied at temperatures between 1200 and 2000°F. Accelerated attack was observed in this temperature range compared with the neighboring temperatures. Thick white oxide coatings were produced, and the reaction was sometimes accompanied by metallic disintegration. X-ray diffraction and metallography were used to study the products and manifestations of oxidation, and thermogravimetric curves are presented for $ZrBe_{13}$ and Nb_2Be_{17}. (auth)

24124 (AEC-tr-5235) OXIDATION IN AIR OF TWO REFRACTORY ALLOYS (NICRAL D AND HASTELLOY X) AT 900 AND 1100°C. J. Sannier, R. Dominget, and R. Darras. Translated for Oak Ridge National Lab., Tenn. from J. Nuclear Materials, 3: 213-25(1959). 20p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, abstract no. 4566.

24125 SCALING BEHAVIOR OF SUPERHEATER TUBE ALLOYS IN ASME HIGH TEMPERATURE STEAM RESEARCH TESTS AT 1100–1500 F. F. Eberle and C. H. Anderson (Babcock and Wilcox Co., Alliance, Ohio). J. Eng. Power, 84: 223-55(July 1962).

The scales formed on seven ferritic and ten austenitic types of commercial tubing for superheater service were examined after 6, 12, and 18 months' exposure to air and to flowing steam of 2000 psi at temperatures of 1100, 1200, 1350, and 1500°F. The effect of temperature and time of exposure on the adherence, thermal-shock resistance, thickness, structure, and chemical composition of the scales was investigated and the relative resistance to scaling of the various alloys evaluated. (auth)

24126 METALLURGICAL EVALUATION OF SUPERHEATER TUBE ALLOYS AFTER 12 AND 18 MONTHS' EXPOSURE TO STEAM AT 1200, 1350, AND 1500 F. C. L. Clark (Timken Roller Bearing Co., Canton, Ohio), J. J. B. Rutherford, A. B. Wilder, and M. A. Cordovi. J. Eng. Power, 84: 258-88(July 1962).

Results are given for austenitic stainless steels and Ni-base Fe alloys. Measurements are made of the tensile properties, hardness, impact resistance, flattening properties, microstructure, tube failure, and bulging. (T.F.H.)

24127 THE EFFECT OF CORROSION BY STEAM AT 1100–1500 F UPON THE HEAT TRANSFER THROUGH SUPERHEATER TUBE ALLOYS. H. L. Solberg (Purdue Univ., Lafayette, Ind.), J. E. Brock, and W. J. Rebello. J. Eng. Power, 84: 289-94(July 1962).

Heat-transfer tests were made on tubular specimens of ferritic and austenitic types of superheater alloys which had been exposed to high-temperature steam for periods of 6, 12, or 18 months, for the purpose of determining the effect of corrosion by steam. Specimens of scaled tubes and new tubes of the same alloy were machined externally to the same dimensions and surfaces, mounted in similar heat exchangers, and tested in series under such conditions that the only difference was in the scaled inner surface of the corroded tube and the bright, smooth, honed inner surface of the clean tube. The heat transfer through ferritic tubes was reduced by as much as fifteen per cent for the temperatures and exposure periods reported upon. The thin, dense scale on the austenitic alloys increased the heat transfer over that of the clean tube by as much as eight per cent, probably because of the increased roughness of the corroded surface. (auth)

24128 CORROSION AND HYDROGEN ABSORPTION PROPERTIES OF NICKEL-FREE ZIRCALOY-2 AND ZIRCALOY-4. S. Kass and W. W. Kirk (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Soc. Metals, 55: 77-100(Mar. 1962). (WAPD-T-1281)

The hot water and steam corrosion and hydrogen absorption properties of the latest additions to the zirconium alloy family, nickel-free Zircaloy-2 and Zircaloy-4, are presented and discussed. The alloys are essentially Zircaloy-2 except that the nickel contents were modified to less than 70 ppm. Both materials exhibit corrosion resistance similar to that of Zircaloy-2. The modified alloys however, absorb a lower amount of corrosion-produced hydrogen than Zircaloy-2. The effects of compositional variations, heat treatment, and fabrication upon the corrosion and hydrogen absorption are presented and discussed. (auth)

24129 KORROZIYA I ZASHCHITA KONSTRUKTSIONNYKH METALLICHESKIKH MATERIALOV. (Corrosion and Protection of Metal Construction Materials). N. D. Tomashev, ed. Moscow, State Publishing House of Literature on Scientific Research, 1961. 260p.

The results of experiments on metal corrosion and protection are reported in a collection of 25 articles. The effects of gaseous corrosion in thermal treatment of various alloys, acid etching of metals and corrosion resistance of chromium–nickel steels, titanium alloys, and niobium and tantalum alloys are discussed. New data are given on the intercrystalline corrosion of stainless steel and corrosion and protection of metals and alloys in high-temperature and chemical environments. (R.V.J.)

Fabrication

Refer also to abstracts 24621, 24626, 24629, 24634, and 24635.

24130 (AD-271377) ULTRASONIC WELDING OF REFRACTORY METALS. Progress Report No. 5, October 1 through November 30, 1961. C. R. Frownfelter (Aeroprojects, Inc., West Chester, Penna.). Jan. 24, 1962. Contract NOw 61-0410-c. 11p.

The reproducibility of weld strength values for 0.005- and 0.010-in. Mo–0.5 Ti as well as the quality of these bonds were evaluated. In one case, the effect of foil interleaf was also investigated. Limited shear strength studies were made with 0.005-in. Nb. (auth)

24131 (DMIC-Memo-152) ELECTRON-BEAM WELDING OF TUNGSTEN. R. E. Monroe and R. M. Evans (Battelle Memorial Inst. Defense Metals Information

Center, Columbus, Ohio). May 21, 1962. Contract AF33(616)-7747. 17p.

The electron-beam welding of commercially pure tungsten indicates that sound crack-free welds can be made if the weld is not restrained during welding. Although the data are not all consistent, welds which are smooth and have minimum fusion and heat-affected zone width should be the strongest and most ductile. Tensile strengths are equivalent to the base metal near the recrystallization temperature but are appreciably lower at room temperature. The ductile-to-brittle transition temperatures for electron-beam-welded tungsten are above that of the base metal. The impact resistance of electron-beam-welded tungsten is very low. (auth)

24132 (NP-11713) HIGH TEMPERATURE CERAMIC STRUCTURES. Quarterly Report No. 23, February 1, 1962 to April 30, 1962. N. E. Poulos, S. R. Elkins, and J. D. Walton (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Contract NOrd-15701. 45p.

Work was carried out on organic silicate impregnating, radome fabricating, and arc-plasma flame glazing. The major effort was expended in radome material evaluation and radome fabrication from slip-cast fused silica. The organo-silicate impregnant was diluted with water to 20 per cent SiO_2 solution for the studies. The organic complex of this material can be burned off to leave pure amorphous silica as the residue. Preliminary data show that simple exposure impregnation is superior to the vacuum-pressure impregnation. Evaluation of the effect of flame glazing the surface of slip-cast fused silica on its electrical properties for radome use was initiated. The initial sample for this evaluation was an unglazed 5 inch diameter cylinder of slip cast fused silica. Several radome tip configurations were flame glazed and shipped to General Dynamics for rain erosion tests. Rain erosion evaluations were performed by mounting the tips on a rocket powered sled which would be driven through a controlled simulated rainstorm. However, no results can be reported because the sample holding device was sheared off during the run. It is not definitely known at this time what caused the sample holder to be sheared off, but it is thought that the holder was impacted by a low flying bird. Studies were initiated to determine the effect on the physical properties of vibrated and nonvibrated pressure cast fused silica. The bars were pressure cast at 0, 20, 40, and 60 psig applied pressure. The results indicated that the vibration increases the transverse strength of slip-cast fused silica when pressure cast. A device was fibricated in an effort to check the accuracy of the Kozeny Equation for the prediction of wall thickness and to study the effect of applied pressure, plaster wall thickness, water content of plaster mold, and plaster water ratio on the casting rate of fused silica slip. No results are available for this report. A study was initiated to develop a fused silica slip which has a "green" modulus of rupture in the range of 2000 to 3000 psi. By obtaining a "green" strength in the range indicated it would be possible to machine a slip-cast fused silica radome before firing, thus increasing the machinability and reducing machining cost because of the relative softness of the silica before firing as compared to the fired state. Transverse strengths in the range of 2000 psi were obtained. A furnace temperature profile was run for the radome furnace constructed during the previous quarter. The results of the profile indicated that both firing methods investigated (shielded and unshielded) produced satisfactory temperature distributions for firing fused silica radomes. A radome, 5½ inches in diameter at the base with an overall height of 13 inches, was received. Gypsum plaster molds were fabricated from the radome. This radome shape will be used for preliminary arc-plasma flame glazing work. Work was initiated, according to a plan recently formulated by the sponsor and contractor, to design and build equipment for fabrication of full scale fused silica radomes with totally arc-plasma flame glazed outer surfaces. Preliminary design of the equipment was completed. (auth)

24133 (RFP-268) THORIUM CANNING METHODS. R. C. Bailie (Dow Chemical Co. Rocky Flats Plant, Denver). June 20, 1962. Contract AT(29-1)-1106. 20p.

An investigation was performed to determine the possibility of canning thorium in an inexpensive and convenient manner that would allow it to be rolled without creating a health physics hazard. The most suitable method was found to be a hot dip in aluminum at 800°C. (auth)

24134 (TID-15337) SKULL MELTING AND CASTING OF URANIUM MONOCARBIDE. H. S. Kalish, F. B. Litton, and J. Crane (Olin Mathieson Chemical Corp., New Haven). Feb. 28, 1961. Contract AT(30-1)-2374. 15p.

Experiments concentrated on the melting of UO_2 plus graphite pellet charges are described. The best atmosphere was found to be 2 parts helium to 1 part argon at 10 in. of mercury absolute pressure. The melting time for the pre-reacted UO_2-graphite charges is 5 minutes; and, for the unreacted UO_2-graphite charges, a three-melt cycle, 8, 5, and 5 minutes is used. Carbon, nitrogen, and oxygen contents were also determined. Microexamination of castings made from either reacted or unreacted UO_2-graphite charges was in general agreement with the chemical analysis. The structure showed no evidence of unreacted constituents in either case. Variation in carbon content within a casting is invariably less than 0.1 wt %. (P.C.H.)

24135 (WAL-460.54/1-1) JOINING OF REFRACTORY METALS—TUNGSTEN. Quarterly Report, June 30, 1961—September 30, 1961. P. Kovach and J. Wulff (Massachusetts Inst. of Tech., Cambridge). Contract DA-19-020-ORD-5236. 8p. (AD-268830)

Lap joints of commercially pure and 1% thoria-doped 0.005 inch tungsten strip were made using nickel or palladium as filler metals. Satisfactory joints were indicated by the fact that in a room temperature bend test the fracture path passed through the joint rather than along it. Satisfactory joints could be produced at 1100°C for a heat treatment time as short as 10 minutes. Satisfactory joints were accompanied by recrystallization at the interface. The extent of recrystallization increased with both time and temperature. Lap joints of similar tungsten strip were made by spot welding using nickel or palladium as filler metals. The strength of these joints was measured by pulling the specimens in tension. Heat treatment of these joints, after spot welding, resulted in an increase in joint strength. (auth)

24136 STUDY OF MECHANISM OF REACTION HOT PRESSING. A. Accary and R. Caillat (Centre d'Etudes Nucléaries, Saclay, France). J. Am. Ceram. Soc., 45: 347-51(July 1962).

The mechanism of reaction sintering was studied in mixtures of uranium—uranium sesquinitride and uranium—silicon. Refractory uranium mononitride of high density may be prepared by hot pressing mixtures of uranium and uranium sesquinitride at 1000°C. Steps of the process are densification of the uranium metal into a continuous uranium matrix and reaction of the uranium sesquinitride with the uranium matrix. On the contrary, during hot

pressing uranium–silicon mixtures react before any densification of the uranium occurs. The pressing temperature required for a given density is then practically the same as for unreacted powders and the previously formed compound. Densification stages of the prereacted compounds may be described by the equations $y = a_2 t^{1/3} + b_2$, $y = a_1 \log t + b_1$, and $y = a_3 t^{-1/3} + b_3$, where y is the shrinkage and t is the time. The first stage is absent during densification of the powder mixtures. (auth)

24137 BETA QUENCHED ZIRCONIUM–10% Cb ALLOY. A. D. McMaster, F. K. Blechinger, and F. W. Kunz (Knolls Atomic Power Lab., Schenectady, N. Y.). Metal Progr., 79: No. 6, (June 1961).

Beta quenched Zr–10% Nb alloy was fabricated as part of a study to determine the quench-aging kinetics of Zr-Nb alloys. X-ray diffraction analysis showed that the material contained retained beta zirconium and a metastable hexagonal phase called omega. A finished surface was obtained and the microstructure revealed. (P.C.H.)

24138 TECHNOLOGY OF MOLDING ZIRCONIUM OBJECTS. G. P. Kalliga, V. A. Kolbasova, and D. N. Poluboyarinov (Mendeleev Inst. of Chemistry and Tech., [USSR]). Ogneupory, No. 1, 28-34(1962). (In Russian)

Processes for fabricating bodies from hydrous suspensions of 6% CaO stabilized crushed ZrO_2 (97.5% ZrO_2 with 1.15% TiO_2) were studied. It is shown that the best results are obtained with hydrochloric acid-washed ZrO_2 at 30% humidity and pH = 1.5 to 2. The density of the casting was 2.8 g/cm^3, and the density of the finished objects was 5.45 g/cm^3. (R.V.J.)

Properties and Structure

Refer also to abstracts 24482, 24606, 24620, 24624, 24625, 24627, 24628, 24630, 24631, and 24633.

24139 (AD-269265) THERMODYNAMIC PROPERTIES OF BI-METALLIC POWDERS. Quarterly Letter Report, January 1962. Willem Versluys and Robert W. Steeves (National Research Corp., Cambridge, Mass.). Jan. 5, 1962. 7p.

A Parr series No. 1200 adiabatic calorimeter was installed, and its heat equivalent determined. A few preliminary runs on the determination of the heat of combustion of Al metal powder revealed that this reaction is very violent. It was found that Al powders are slow to react with 1 N HCl at room temperature. Only at temperatures exceeding 55°C did reaction rates become high enough to complete the reaction in the course of minutes. (auth)

24140 (AD-269729) BERYLLIUM OXIDE. A Literature Survey. Theodore Cheron, comp. (Aerospace Corp., El Segundo, Calif.). Sept. 1, 1961. Contract AF 04(647)-930. 103p. (TDR-930(2240-01)-TN-1)

References (283) are given to reports and U. S. and foreign open literature sources published from 1955 to 1961. Emphasis is placed on beryllium oxide, its physical, chemical, and mechanical properties, preparation, and fabrication methods. This is followed by some information on intermetallic compounds of beryllium and certain of its alloys, along with the toxicity of beryllium and beryllium oxide and safety measures. Separate author and corporate indexes are included. (P.C.H.)

24141 (AD-270235) THE ELECTRICAL BEHAVIOR OF REFRACTORY OXIDES. Bi-Monthly Progress Report 203-6, November–December 1961. (System Research Labs., Inc., Dayton, Ohio). Jan. 19, 1962. Contract AF33(616)-7748. 11p.

Experiments were initiated to determine the influence of small deviations from stoichiometry on the electrical properties of pure ZrO_2. A hot-pressed wafer of oxygen deficient zirconia with platinum electrodes was equilibrated at 1000°C in an oxygen partial pressure of 2×10^{-9} Torr. The measuring frequency was 10^4 radians/sec (1592 cps). The furnace temperature was then raised to 1050°C at the same oxygen pressure and the sample reequilibrated. This treatment affected some reoxidation. Polarization measurements indicated that the conductance was near 100% electronic at all points. Low temperature data suggest a conduction mechanism involving anion vacancies (or excess cations). As the number of vacancies is decreased by slight reoxidation, the conductance decreases, but the activation energy remains essentially the same. The conductance above 700°C represents a process insensitive to small changes in the zirconium to oxygen ratio. (P.C.H.)

24142 (AD-270673) ELECTRIC AND MAGNETIC PROPERTIES OF VERY THIN FILMS WITH SPECIAL EMPHASIS ON SUPERCONDUCTIVITY. Final Report, June 1, 1958–August 31, 1961. Rolfe E. Glover, III (North Carolina. Univ., Chapel Hill). [Aug. 31, 1961]. Contract Nonr-855(08). 35p.

A summary of the work reported previously in a series of technical reports is given in which it is noted that superconducting currents were measured for tin films which were thin compared with penetration depth. Average current densities were found to be 10^6 to 10^7 amp/cm^2. Magnetic fields produced by currents driven through the superconducting fields were orders of magnitude larger than the bulk critical field. Very thin Pb films showed well-defined superconducting transition temperatures. Charging was found to affect normal state conductivity and the superconducting transition temperature. Microwave transmission and reflection measurements were also made. (J.R.D.)

24143 (AERE-R-3973) THE THERMAL CONDUCTIVITY OF ARTIFICIAL GRAPHITES AND ITS RELATIONSHIP TO ELECTRICAL RESISTIVITY. I. B. Mason and R. H. Knibbs (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Mar. 1962. 37p.

Measurements of thermal conductivity at room temperature covering a wide range of commercial and experimental graphites are presented. In addition, some graphites of interest in the nuclear field were examined up to 600°C. It is demonstrated that for a given material thermal resistivity (inverse conductivity) varies linearly with electrical resistivity when either the orientation or the crystallinity vary. Expressions correlating these two quantities are given. It is also found that one such expression fits the data for over forty different graphites, and enables the thermal resistivity to be estimated for electrical measurements to within ±15%. A fairly simple theoretical analysis of the data suggests that the temperature variation of thermal conductivity of most graphites can be represented by a single family of curves. On this basis it is indicated how values of thermal conductivity at elevated temperatures may be estimated from room temperature data. (auth)

24144 (AERE-R-4062) THE EMISSION OF FISSION PRODUCT RARE GASES FROM UO_2–BeO AND UO_2–ThO_2–BeO SPECIMENS DURING NEUTRON IRRADIATION IN BEPO. A. R. Palmer (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). May 1962. 35p.

Emission of fission gases from compacted samples of

UO_2–BeO and UO_2–ThO_2–BeO, in which most of the movement occurs in the BeO grains, is very slow. The concentration change is of the order 5×10^{-9} cm^3/sec at 1000°C. Measurements are reported and analyzed for both in-pile and out-of-pile conditions over the temperature range 200 to 1000°C. (auth)

24145 (ANL-6268) DEVELOPMENT OF LIQUID-PHASE SINTERING TECHNIQUES FOR MOLYBDENUM ALLOYS. Final Report (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Nov. 10, 1960. For Argonne National Lab., Ill. Contract W-31-109-Eng-38, Subcontract 31-109-38-1062. 46p.

An envelope-type microstructure produced by liquid-phase sintering techniques was used to develop ductile molybdenum-base alloys for sodium-cooled fast reactor application. A total of 105 compositions was examined; 21 showed evidence of room-temperature ductility, and a number of other compositions appeared promising. The prerequisites for obtaining ductile liquid-phase sintered materials were demonstrated. The most ductile alloys produced are based on the Mo–Pd–Cu and Mo–W–Ni–Fe systems. Molybdenum-base compositions were developed which could be rolled to 90% reduction in thickness at room temperature. The compactibility of selected alloys with uranium at 750°C and liquid sodium at 650°C was studied. In both cases the presence of iron and nickel was found to be deleterious. Although alloys compatible with uranium were produced, the specimens exposed to liquid sodium all showed evidence of attack to varying degrees. Two compositions based on the Mo–W–Ni and W–Cr–Ni systems, respectively, appear to hold promise as potential canning materials for sodium-cooled fast reactor application. (auth)

24146 (ASD-TDR-62-11) IMPURITY ATOM-DISLOCATION INTERACTIONS AND SUBSEQUENT EFFECTS ON MECHANICAL PROPERTIES OF REFRACTORY METALS. M. A. Adams and H. Nesor (Materials Research Corp., Orangeburg, N. Y.). Feb. 1962. Contract AF33(616)-7596. 33p.

Studies were made of the strain-aging behavior and the effect of pre-straining and high temperature annealing on molybdenum crystals of two different purity levels prepared by electron beam melting. One batch of crystals contained an average of 20 ppm total interstitial impurities, the other an average of 250 ppm interstitials with the major constituent being carbon. Yield point experiments revealed no strain-aging in either material in the "as-grown" condition, but after a high temperature anneal followed by rapid cooling the material containing carbon showed appreciable aging effects, and the purer material weak effects. The results are explained in terms of the low solid solubility of the interstitial elements in molybdenum under equilibrium conditions at moderate temperatures. The second series of experiments showed that pre-straining and annealing treatments which produce a sub-structure in molybdenum, also result in a strengthening of the material. The strengthening increases with increasing pre-strain and with increasing carbon content. The results indicate that sub-grain boundaries strengthen molybdenum in a qualitatively similar way to ordinary grain boundaries. (auth)

24147 (ASD-TDR-62-90) SYNTHESIS AND PYROLYSIS OF REFRACTORY METAL ALKOXIDES. K. S. Mazdiyasni, C. R. Connors, and C. A. Pratt (Aeronautical Systems Div., Wright-Patterson AFB, Ohio). Jan. 1962. 30p.

Metal alkoxides were prepared based on the D. C. Bradley, et al., procedure. Sufficient quantities of principally zirconium isopropoxide and tetra-tert butoxide were produced to use as starting material for impregnation and coating purposes. The compounds were prepared by simple chemical reactions but under extremely dry atmosphere. The purity, concentration, order of stability, melting temperature, vapor pressure, and decomposition temperature of the compound are described. While the compound may be applicable to coating various materials, to date experiments were limited to coating graphite substrates. The compound was pyrolyzed at 250 to 500°C. Tetragonal-monoclinic thin film ZrO_2 was deposited on graphites of varying purity. (auth)

24148 (ASD-TR-61-676) DEVELOPMENT OF PROTECTIVE COATINGS FOR TANTALUM-BASE ALLOYS. William D. Klopp, Carroll F. Powell, D. J. Maykuth, and Horace R. Ogden (Battelle Memorial Inst., Columbus, Ohio). Jan. 4, 1962. Contract AF33(616)-7184. 98p.

Straight silicide coatings and modifications with aluminum, boron, chromium, manganese, molybdenum, titanium, and vanadium were applied to tantalum, Ta-10W, Ta-V, Ta-10Hf-5W, and Ta-30Nb-5V by pack-cementation techniques. These coated materials were evaluated primarily by static, cyclic, and defect oxidation studies in the temperature range 1200 to 2700°F. Less extensive studies were conducted on tantalum coated with aluminum, chromium, hafnium, titanium, zinc, and Al_2O_3. (auth)

24149 (BMI-X-204) PROGRESS ON USAEC/AECL COOPERATIVE PROGRAM, QUARTERLY REFORT FOR PERIOD MARCH–MAY 1962. Stanley W. Porembka (Battelle Memorial Inst., Columbus, Ohio). June 11, 1962. Contract W-7405-eng-92. 7p.

Progress is reported in investigations of cold-bonding methods and creep-rupture properties in areas associated with heavy water and organic moderated reactors. Roll-formed joints incorporating Ag-alloy liners exhibited strengths approaching that of Zircaloy members. Various parameters were evaluated in explosive-welding tests yielding welds which would withstand a $\frac{1}{8}$-in.-radius blend without failure. Upset forming and forge welding of SAP alloy end-cap configurations on tube ends provided pressure-tight assemblies. Details and data concerning the long-term creep-rupture program on SAP alloys are included. (J.R.D.)

24150 (CNEN-113) METALLURGICAL EXAMINATION OF URANIUM-RICH TERNARY ALLOYS CONTAINING MOLYBDENUM AND CARBON. C. Fizzotti and F. Squadrelli Saraceno (Parsons (C. A.) and Co., Ltd., Newcastle-upon-Tyne, England and Italy. Comitato Nazionale per l'Energia Nucleare, Rome). Apr. 1962. 24p.

Ternary alloys containing uranium, molybdenum, and carbon were investigated with the purpose of reducing the concentration of molybdenum in binary uranium alloys. Carbon was chosen because UC increases the molybdenum concentration in the remaining metallic matrix which would very probably improve its stability under irradiation. Three uranium-molybdenum alloys containing respectively 1 and 2 wt % carbon were thermally treated and the obtained structures compared with the binary uranium–molybdenum alloys of the same composition. Changes in density for molybdenum and carbon addition are also given. (auth)

24151 (DC-61-2-133) ISSUE DESIGN DATA ON INCONEL X. Status Report–Milestone No. 3A. M. A. Pugacz (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Feb. 27, 1961. Contract AT(11-1)-171. 30p.

Design properties of Inconel X forged bar and sheet material are presented along with new data on plate material. The information is supplemental to that presented in report DC-60-12-120 which is primarily on Inconel X plate material. (J.R.D.)

24152 (DMIC-Memo-154) THE EFFECTS OF DECARBURIZATION ON THE PROPERTIES OF ULTRAHIGH-STRENGTH STEELS. W. R. Warke and A. R. Elsea (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). June 18, 1962. Contract AF33(616)-7747. 21p.

A review is given of currently used methods of measuring and controlling decarburization, and present knowledge on the effect of decarburization on the mechanical properties of ultrahigh-strength steels is described. Data indicate that a small controlled amount of decarburization is beneficial from the standpoint of resistance to brittle fracture. On the other hand, decarburization appears to lower the fatigue strength of steels. It is concluded that for any given application, the relative importance of these two factors should be evaluated before a decision is made regarding the control of decarburization. (P.C.H.)

24153 (DMIC-Memo-156) PROPERTIES OF MARAGING STEELS. D. C. Drennen and D. B. Roach (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). July 2, 1962. Contract AF33(616)-7747. 54p.

Properties are described of a series of high-nickel martensitic steels which are strengthened by the precipitation-hardening mechanism. These steels can be heat treated to yield strengths of 250,000 to 300,000 psi with excellent toughness. Included are discussions concerning terminology of the steels, nominal composition, production characteristics, and present status. (J.R.D.)

24154 (GA-3254) INVESTIGATIONS OF CARBIDES AS CATHODES FOR THERMIONIC SPACE REACTORS. Fourth Interim Progress Report for the Period from March 1 through May 31, 1962. A. F. Weinberg, R. G. Hudson, L. Yang, and F. D. Carpenter (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Contract NAS 5-1253. 68p.

The physicochemical properties of mixed carbides of uranium and zirconium are being measured to determine the usefulness of these materials as nuclear-heated thermionic emitters or as the nuclear fuel for refractory-metal thermionic cells. Property measurements of other carbide systems having potential as thermionic emitters are also being performed. Vapor-loss data were obtained in vacuum for a specimen of nominal composition 90 mole-% UC–10 mole-% ZrC over the temperature range 1988 to 2083°K. The rate of weight loss can be expressed as follows: $\log \dot{w} = 9.72 - 3.05 \times 10^4$ (1/T), where $\dot{w}$ is the rate of weight loss in mg/cm^2/sec and T is the absolute temperature. A cesium-vapor environment at a pressure of 0.06 to 0.09 mm Hg at 1990° ±14°K was not found to significantly change the rate of weight loss of this specimen from the rate of weight loss measured in vacuum at the same temperature. Depletion of the surface uranium content by over 30% of the bulk concentration (based on weight percentages) was found by electron-microprobe techniques in specimens of low UC content whose rate of weight loss was previously studied. The rate of weight loss of a specimen of nominal composition 20 mole-% UC–80 mole-% HfC was found to be 1.59×10^{-2} mg/cm^2/sec at 2063 ±11°K. Electron emission in vacuum was determined as a function of temperature for specimens of nominal composition 90 mole-% UC–10 mole-% ZrC and 20 mole-% UC–80 mole-% HfC. Diffusion experiments showed that rhenium and tungsten–25 wt-% rhenium barrier layers are ineffective in stopping carbon diffusion between UC_2 and molybdenum or tungsten at 1800°C. However, ZrC provides an effective barrier. Studies of the containment of 10 mole-% UC–90 mole-% ZrC by tantalum were made using electron-emission measurements from the tantalum surface as the monitoring technique. These studies showed that at 1680°C less than 57 hr is required for sufficient diffusion of the fuel components through the tantalum to cause a significant change in the electron-emission characteristics. Electron-microprobe analyses were employed to gain further data on UC–ZrC, ZrC–W, and UC–W interactions. Electrical-resistivity measurements were completed for a specimen of nominal composition 80 mole-% UC–20 mole-% ZrC over the temperature range from room temperature to 2400°K. Thermal-conductivity measurements were obtained for ZrC in the temperature range 1100° to 1200°C. The average value obtained from three different specimens is 0.107 cal-cm^{-2}-cm-sec^{-1}-°C^{-1}. (auth)

24155 (GEAP-3875) MATERIALS FOR NUCLEAR SUPERHEAT APPLICATIONS. A Literature Survey. C. N. Spalaris, F. A. Comprelli, D. L. Douglass, and M. B. Reynolds (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Jan. 5, 1962. Contract AT(04-3)-189. 137p.

A literature survey was conducted on candidate metal alloys for use in high-temperature nuclear superheated steam environments. Resulting information is presented in sections on practical experience of material performance in high-temperature steam service conditions, oxidation and corrosion behavior of materials at high temperatures, high-temperature mechanical properties, and effects of irradiation on the physical properties of high-temperature alloys. (J.R.D.)

24156 (GV-298) IMPROVEMENT OF THE WORKING CHARACTERISTICS OF IRON–CHROMIUM–ALUMINUM ALLOYS. Quarterly Report No. 1, November 16, 1955–February 10, 1956. R. R. Denison and R. J. Van Thyne (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Feb. 21, 1956. For General Electric Co., Aircraft Nuclear Propulsion Dept., Cincinnati. Contract AT(11-1)-171; Subcontract AT-36. 13p.

Studies were made on the extension of the workable compositional limits in the Fe–Cr–Al system. Preliminary alloys were prepared by melting and casting in a vacuum induction furnace. An Fe–35% Cr–7.5% Al–0.08% N alloy was formed to ductile 0.014 in. sheet by conventional working practices. (auth)

24157 (IS-448) DIFFUSION IN CERAMIC SYSTEMS. A Selected Bibliography. Michael F. Berard (Ames Lab., Ames, Iowa). May 1962. Contract W-7405-Eng-82. 58p.

References (165) on diffusion in ceramic systems such as oxides, silicates and glasses, borides, and carbides and graphite, are given to books, reports, and U.S. and foreign journals published from 1904 to 1961. Data on the frequency factor, D_0, and activation energy, Q, are given for various elements and systems. A separate author index is also included. (P.C.H.)

24158 (K-1526) AN IBM 7090 PROGRAM FOR COMPUTING THE FERMI-LEVEL IN NON-METALS. J. W. Miller (Oak Ridge Gaseous Diffusion Plant, Tenn.). June 25, 1962. Contract W-7405-Eng-26. 153p.

An IBM 7090 computer program for calculating the Fermi-level in non-metals is described. The program can compute the Fermi-level as a function of temperature and donor and acceptor concentration for any crystal for which the band structure is known provided the doping atoms are different from the base material by only one outer shell

electron. The Fermi-level was computed for germanium and silicon with gallium and antimony doping, and it is shown that the Fermi-level depends primarily on the excess carriers in the crystal. (auth)

24159 (MAB-110-M(15)) FINAL REPORT OF THE MATERIALS ADVISORY BOARD PANEL ON THE DEPARTMENT OF DEFENSE TITANIUM ALLOY SHEET ROLLING PANEL. (National Research Council. Materials Advisory Board). June 1, 1962. 365p.

The development and evaluation of high strength Ti alloy sheet for application in aerospace vehicles was greatly accelerated by an inter-Service program coordinated through the Department of Defense. In 1956, the Materials Advisory Board of the National Academy of Sciences–National Research Council was asked to participate in the monitoring of this joint endeavor and has had responsibility for providing technical guidance to it through the operation of the Materials Advisory Board Titanium Alloy Sheet Rolling Panel and subpanels. This report is a review of the Department of Defense Ti Alloy Sheet Rolling Program between 1956 and 1961. Subpanel reports deal with alloy selection, sampling, rolling behavior, heat treatment, welding, analysis, structural design data collection, evaluation, fabrication, and strain effects. (T.R.H.)

24160 (MAB-184-M) REPORT OF THE SUBPANEL ON QUALITY SPECIFICATIONS. REFRACTORY METALS SHEET ROLLING PANEL. (National Research Council. Materials Advisory Board). June 8, 1962. 19p.

Specifications are presented establishing the sampling considered appropriate and necessary to verify that a manufacturer is producing a uniform, consistent product. The specification covers Nb, Mo, Ta, W, and their alloys procured in sheet form. The types of tests and methods of sampling are described. Topics covered include: product limitations, identification, sampling, visual inspection, dimensional tolerances, sonic inspection, chemistry, tensile properties, bend transition temperature, metallographic and hardness tests, and recrystallization temperature. (M.C.G.)

24161 (NAA-SR-Memo-7172) MECHANICAL PROPERTIES, THERMAL EXPANSION, COMPATIBILITY AND HEAT TREATMENTS OF PbTe. P. E. Elkins (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Feb. 26, 1962. Contract [AT(11-1)-Gen-8]. 31p.

Compressive, tensile, shear, and vibration-shock tests were carried out on lead telluride materials. All of the materials behaved as brittle intermetallic compounds. The pressed and sintered (P&S) p-type material from 3M was stronger and less ductile in compression than the corresponding n-type material. Extruded n-type material from Trancoa was stronger and less ductile than the 3M P&S n-type material. All of the PbTe materials had high thermal expansion coefficients of approximately 11.4 μ in./in.-°F from >70 to 1000°F. No bond or reaction zones were observed in compatibility tests of PbTe with Be, Al, or Mg. However, these results were somewhat inconclusive. Ni, Ag, and Pt formed liquid eutectics after short-time anneals at 1200°F. After 200 hr at 1200°F, a diffusion layer formed between Au and PbTe. All attempts to braze iron shoes to PbTe elements were unsuccessful. Isothermal heat treatments of PbTe were carried out for 500, 674, and 855 hr at 1200°F and for 500, 1000, and 1500 hr at 1000°F. No detrimental compositional, structural, or electrical property changes occurred during the heat treatments. (auth)

24162 (NP-11654) MECHANICAL AND PHYSICAL PROPERTIES OF THE REFRACTORY METALS, TUNGSTEN, TANTALUM, AND MOLYBDENUM ABOVE 4000°F. L. F. Glasier, Jr., R. D. Allen, and I. L. Saldinger (Aerojet-General Corp., Azusa, Calif.). Apr. 1959. 89p. (M-1826)

Methods were developed and tests conducted on pure W, Ta, and Mo to provide mechanical and physical property data in the temperature range 2200 (4000°F) to 3300°C (6000°F). Data include modulus of elasticity, proportional limit, ultimate tensile strength, yield strength, elongation, thermal expansion, thermal conductivity, and both total and spectral (0.65μ) emissivities. It was found that the mean coefficients of linear thermal expansion for Mo, Ta, and W increase with temperature at an increasing rate. The total emissivities increase with temperature, usually at a decreasing rate, between 2300°K and the respective melting points. The spectral emissivities of Ta and W decrease linearly with temperature between 2300°K and the respective melting points, while Mo is constant within this temperature span. The thermal conductivities decrease linearly with temperature from 2300°K to the respective melting points. (P.C.H.)

24163 (NP-11711) HIGH TEMPERATURE OXIDATION RESISTANT COATINGS FOR TANTALUM BASE ALLOYS. Quarterly Progress Report No. 2, February 1, 1962 to April 30, 1962. L. Sama (General Telephone and Electronics Labs. Inc., Bayside, N. Y.). May 15, 1962. Contract AF33(657)-7339. 35p. (TR-62-460.1)

Tin–aluminum base coatings applied by a cold spray-hot vacuum diffusion technique were studied further on Ta-10 W and Ta-10 Hf-5 W and work initiated on Ta–30 Nb–7½ V. Refractory additions to the coatings were optimized for Ta–10 W and the use of aluminum-silicon in tin was found beneficial for Ta–30 Nb–7½ V. Furnace and oxy-acetylene torch tests were performed at temperatures from 1100 to over 3000°F. Diffusion treatments in vacuum, hydrogen, and argon were compared for coatings on Ta–10 W. Oxide formation on Ta–10 W coatings at various temperatures was studied by x-ray diffraction. The oxidation behavior of various tin–aluminum alloys and of the intermetallic (Ta–30 Nb–7½ V) Al_3 was also studied, together with interactions of three alloys with Al_2O_3 at elevated temperatures in vacuum. (auth)

24164 (NP-11778) TRANSITION PHASE IN Mg–14Li–1Al–1Zn ALLOY. James V. Rinnovatore and Milton Schwartz (Frankford Arsenal. Pitman-Dunn Lab., Philadelphia). Feb. 1962. 23p. (FA-R-1623)

Mechanical property studies and x-ray diffraction work were performed on three Mg–Li base cast alloys (Mg–14Li–1Al–1Zn, Mg–13.6Li–4Al–Zn, and Mg–14.1Li–1Al). Tensile properties of the alloys in the following conditions were determined: cast; cast and aged; and cast, and solution treated, and aged. Debye-Scherrer x-ray diffraction patterns were taken of all alloys in the various conditions. A transition type phase was detected in the two quaternary alloys. X-ray diffraction lines from this phase corresponded to an Fd.. (Fd3 or Fd3m) space group with a lattice parameter of approximately 6.7Å. Prolonged aging at 200°F resulted in the transformation of this phase to the stable AlLi compound. This phase was not detected in the ternary alloy, but prolonged aging produced the AlLi phase. (auth)

24165 (NP-11824) EVALUATION OF A HIGH STRENGTH COLUMBIUM ALLOY (AS-55) FOR ALKALI METAL CONTAINMENT. Quarterly Report No. 2, February 25, 1962 to May 25, 1962. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Contract NAS 3-2140. 83p.

Activities are described in a program to determine the

properties of Nb-base alloys for alkali metal containment materials in nuclear turboelectric space power systems. The material being investigated has a nominal composition of Nb–5% W–1% Zr–0.06% C with a 1% Y addition. The program status is reported concerning the arc melting investigation, ingot conversion, evaluation of AS-55 sheet, and corrosion testing. (J.R.D.)

24166 (NP-11854) THE USE OF HIGH ROTATIONAL SPEED TECHNIQUES AS A LABORATORY METHOD FOR THE STUDY OF MECHANICAL PROPERTIES OF METALS AT ELEVATED TEMPERATURES. Final Report. A. R. Kuhlthau (Virginia. Univ., Charlottesville. Research Labs. for Engineering Sciences). May 1962. Contract DA-36-034-ORD-9RD. 59p. (WAL-116/4; EP-4428-101-62U)

The feasibility of using high rotational speed techniques for the study of metals at elevated temperatures was examined. In particular, the application of these techniques to achieve high rates of strain and rapid heating rates are examined. Two types of apparatus are considered. The first utilizes a flat disk specimen rotated by a high-speed turbine. The second consists of a small cylindrical sample freely suspended by electromagnetic means. Two methods for rapid heating are considered. Indirect methods such as r-f heating, electron bombardment, or radiant heating seem to offer the best possibilities. Reasonably rapid heating rates can be obtained by dissipating 2 to 5 kw of power in a disk rotor of 2 to 4 cm radius. Heating by air friction is also possible. Heating rates approaching 260°C/30 sec with a 2.75 hp turbine or 480°C/30 sec with a 20 hp turbine appear possible. The electromagnetic suspension technique is not capable of high rates of strain, but appears attractive for studies of the effect of heating rates at high stress levels. Some interesting observations of creep at constant high stress level and a constant moderate temperature level were made using an electromagnetically suspended rotor. (auth)

24167 (NP-11899) REFERENCES ON MOLYBDENUM DISULFIDE AS A LUBRICANT. Katherine V. Koeniges, comp. (Climax Molybdenum Co., New York). June 1962. 62p.

Over one thousand references on the performance and potential of molybdenum disulfide in the lubrication field are given to journals, reports, and patents published from 1941 to 1962. The references are listed alphabetically according to author except for the unauthored papers or articles, which are listed according to the year of publication. A list of U.S. Military Specifications which contain MoS_2 is also included. (P.C.H.)

24168 (NYO-2694) THE DEVELOPMENT OF URANIUM CARBIDE AS A NUCLEAR FUEL. Second Annual Report (Phase 2), May 1, 1960–August 31, 1961. H. S. Kalish, F. B. Litton, J. Crane, and M. L. Kohn (United Nuclear Corp. Fuels Div., New Haven). Nov. 30, 1961. Contract AT(30-1)-2374. 74p.

Research was completed on the reaction of methane and propane with uranium metal. The experimental conditions were determined for preparing 4.4 and 4.8 wt. % carbon uranium carbide by the methane and propane reactions. In the methane reaction, uranium monocarbide powder was made by passing a deoxidized and dried four to one mixture of methane to hydrogen flowing at the rate of 0.7 liters per minute over uranium powder for two hours at 750°C. The experimental work showed that 88% of the carburization was obtained during heating the retort to reaction temperature, and that from 60 to 70% of the methane combined with the uranium in the dynamic system. In a series of six runs to produce uranium monocarbide, the total carbon was reproduced to within 0.2 wt %, the average free carbon was 0.25 wt %. In addition, the methane produced powders contained an average of 5700 ppm nitrogen and 5600 ppm oxygen, respectively. The latter two impurity elements were attributed to their presence in the carburizing gas, and, undoubtedly, could be substantially reduced by inserting a complex system for gas purification. However, propane was commercially available in higher purity and at lower cost than methane, consequently carburization with propane appeared to be a more attractive route for obtaining a high quality uranium carbide product. The propane reaction was investigated by passing dried chemically pure tank propane over uranium powder at 500 to 650°C for various times from fifteen minutes to three hours. In this experimental work, 600 grams of bulk uranium was charged to the retort, and converted to powder by the hydride reaction. The uranium powder reacted with propane flowing at the rate of two liters per minute. It was observed that the total carbon content and the rate of carburization of the uranium powder increased with increased temperature. At a particular carburizing temperature, in addition to the carburizing time, the total carbon content of the product was related to the rate at which the retort was heated to the carburizing temperature. In a series of six runs using a prescribed heating rate, a total carburizing time cycle of 130 minutes and an average carburizing temperature of 620°C, the total carbon content was reproduced to within 0.1 wt %. The average nitrogen and oxygen content was less than 100 and 1500 ppm, respectively in the product. Although the first experiments with propane wt % indicated a variable free carbon content from about 0.25 to over 1.0 wt %, the free carbon was reduced in the latter runs to very low values by using a copper insert in the retort and by flushing the retort with argon at the end of the run. The sintering characteristics of uranium carbide powders prepared by the methane and propane reactions were investigated. Uncombined uranium in the structure pronouncedly affected the sintered densities of both powders. In the methane produced powder, at least 1 at. % of free uranium was necessary in the structure to obtain sintered densities greater than 13 g/cm^3. The free uranium in the specimen was calculated on the basis of the total carbon, nitrogen, and oxygen content, assuming that nitrogen and oxygen replaced carbon in the uranium carbide structure. Densities in the order of 11.0 g/cm^3 were obtained by mercury immersion after sintering 4.8 wt % carbon methane powder for three hours at 1800°C. Uranium volatilization occurred during vacuum sintering, particularly from powders containing uncombined uranium. The sintered density was increased only 0.4 g/cm^3 by increasing the sintering temperature from 1800 to 2200°C. In the propane produced powder, no correlation was observed between sintered density and either the die lubricant or the compacting pressure. In order to reduce uranium volatilization, the sintering temperature of 4.4 ± 0.1 wt % carbon powder was reduced to 1200°C. On compacting a powder containing 4.3 wt % carbon at 60 tsi using 0.5% camphor as a die lubricant and vacuum sintering for three hours at 1200°C, the sintered density was 13.8 g/cm^3 as determined by immersion in carbon tetrachloride. Higher sintering temperature and lower compacting pressure were required for processing 4.8 ± 0.1 wt % carbon powder. Using 0.5% camphor as a die lubricant and a compacting pressure of 40 tsi, a powder containing 4.7 wt % carbon was vacuum sintered for three hours at 1800°C to a density of 11.9 g/cm^3 as determined by mercury immersion. After completing preliminary tests, modifications in design of components for the skull furnace

were made to improve reliability of the casting operation and soundness and uniformity of the castings. A magnetic coil was constructed for the base of the ladle to control arc deflection and stir the melt. In addition, a mold assembly was made to permit cavity preheating for outgassing the molds. Perhaps the major improvement in the skull furnace was the conversion of the electrically actuated ladle tilting device and electrode drive to hydraulic operation. Evaluation was made of UO_2-graphite pellets as charge material for skull casting uranium carbide. Charges consisted of unreacted UO_2-graphite pellets, as well as pellets of uranium carbide prepared by reacting UO_2 with graphite in an induction furnace at 1700°C. Both types of charges yielded homogeneous uranium carbide castings low in nitrogen (less than 100 ppm) and oxygen (less than 430 ppm). Melting unreacted charges of UO_2-graphite resulted in very high spatter loss compared to melting the reacted pellets. Also, control of carbon content from casting to casting was superior using reacted pellets. The influence of the carbon content of the skull on that of the casting was found to be significant for either type charge, but was a greater factor in casting from the unreacted type charge. An economic cost comparison was made for the production of uranium carbide castings from unreacted and reacted type charge materials. The comparison showed that the higher cost incurred by material losses associated with skull melting unreacted pellets far outweighed the labor and capital equipment cost advantage the processing of unreacted type charge had over the reacted charge material. Castings $\frac{1}{4}$ in. and $\frac{7}{16}$ in. in diameter by 6 in. long were made, the former as single castings, the latter as both single castings and as three rod clusters. The quality of casting surface was found to depend principally upon superheat in the melt and the uniformity of the pour. In addition, mold outgassing and thin walls (about $\frac{1}{16}$ in.) were found to be requisites for graphite molds for obtaining castings with good surface for $\frac{1}{4}$ in. diameter castings; however, mold preheat was of no value for $\frac{7}{16}$ in. diameter castings, and resulted in visible interaction between mold and casting at preheat temperatures of 700°C and above. Pipe in varying degrees was found near the top of almost all castings of either size. A bar of uranium carbide prepared by reacting compacted UO_2-graphite powder at 2000°C in vacuo, was melted consumably in a button furnace. The determination of the physical properties of uranium carbide prepared by skull arc melting and powder metallurgy methods and the effect of carbon content variation on the properties was started. The thermal expansion was determined from room temperature to 1000°C, and found to decrease with increasing carbon content. The arc cast material appears to have a somewhat higher thermal expansion than the powder metallurgy material. Compatibility tests were also started and showed that 4.8 wt % carbon uranium carbide had less tendency to react with potential cladding materials than 5.2 wt % carbon uranium carbide. An extension of the compatibility data is needed to obtain conclusive results. The program to determine the effect of composition and method of fabrication on the irradiation stability of uranium carbide was started. The design of the irradiation capsules and the fuel containers was completed and fabrication of component parts and the specimens is progressing. (auth)

24169 (NYO-9430) DIFFUSION IN COBALT–NICKEL ALLOYS. Report No. 4. Ken-ichi Hirano, R. P. Agarwala, B. L. Averbach, and Morris Cohen (Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy). June 6, 1962. Contract AT(30-1)-1975. 25p.

Self-diffusivities of Co^{60} and Ni^{63} in cobalt-nickel solid solutions exhibit a greater activation energy below the Curie temperature (T_c) than above. Values of $\Delta Q = Q$ (ferromagnetic) $- Q$ (paramagnetic) are approximately equal to RT_c. This is interpreted to indicate that the increment in activation energy arises from an increase in the formation energy of a vacancy in the ferromagnetic lattice, with the additional binding energy arising from the interaction of a spin with the Weiss field. (auth)

24170 (ORNL-TM-249) TESTS OF BEARING MATERIALS FOR THE EXPERIMENTAL THROUGH-TUBES IN THE EGCR. R. E. MacPherson and A. M. Smith (Oak Ridge National Lab., Tenn.). July 16, 1962. Contract W-7405-eng-26. 29p.

The four experimental through-tubes provided in the Experimental Gas Cooled Reactor will extend directly through the core of the reactor and penetrate both the upper and lower pressure vessel heads. Each tube is anchored in an upper head nozzle and the bottom end is allowed to slide in a lower head nozzle. This lower nozzle is basically a "T" section that provides bottom access to the through-tube and a side access for the piping which connects the through-tube to the experimenter's cell. Due to differential thermal expansion of the through-tubes relative to the reactor pressure vessel, vertical movement of the through-tube within the "T" section will be experienced. At the same time a horizontal thrust applied to each tube by thermal expansion of the piping to the experimental cell will result in metal-to-metal contact between each tube and the lower "T" section. Tests were conducted on three types of bearing material proposed for use on the through-tubes and "T" sections to minimize galling which can be expected to occur. Stellite No. 12 has been demonstrated to be an adequate bearing material for the intended application. (auth)

24171 (R61CAP69) MECHANICAL PROPERTIES OF DISPERSION STRENGTHENED ALUMINUM ALLOYS. D. G. Boxall and J. W. Standish (Canadian General Electric Co., Ltd. Civilian Atomic Power Dept., Peterborough, Ont.). Jan. 1962. 75p. (AECL-1532)

The mechanical properties including stress rupture of extruded bar and thin wall tubes of dispersion strengthened Al alloys were studied at room and at elevated temperatures. Superior mechanical properties at elevated temperatures were confirmed. It was found that the mechanical properties are affected by fabrication conditions and have marked directionality, and that cold work reduces the stress rupture strength at elevated temperatures. (auth)

24172 (SSC-137) LOW-CYCLE FATIGUE OF METALS—LITERATURE REVIEW. First Progress Report. J. T. P. Yao and W. H. Munse (Illinois. Univ., Urbana). Oct. 31, 1961. Contracts NObs-77008 and NObs-72046. 37p. (AD-266543)

Information on the low-cycle fatigue behavior of metals is summarized. An evaluation on type of test, cyclic rate, stress concentration, crack propagation, material property change, and method of analysis is given. An appendix referring to essential information on each experimental investigation is also included. 69 references are given. (P.C.H.)

24173 (TID-15819) STUDIES OF ALLOY FORMATION. Annual Report Covering the Period, May 15, 1961 to May 15, 1962. W. E. Wallace (Pittsburgh. Univ.). Contract AT(30-1)-647. 28p.

The magnetic behavior of Pr, Nd, and Sm hydrides is being studied. Chemical and magnetic structures of HoH_2, HoD_2, and TbH_2 were determined. (M.C.G.)

24174 (TID-16032) AN INVESTIGATION OF THE EFFECT OF METALLIC ADDITIONS UPON THE OXIDATION RESISTANCE OF $NbAl_3$. Quarterly Progress Report

No. 1, September 1, 1961–February 28, 1962. Ronald L. Wells, Donald T. Klodt, and Charles E. Lundin (Denver. Univ. Denver Research Inst.). Mar. 1962. Contract AT (11-1)-1092. 13p. (DRI-2032)

The effect of additions of Ti, V, Zr, Sn, or Si on the air-oxidation resistance of $NbAl_3$ was investigated. $NbAl_3$-compound alloys containing up to 10 wt.% of the additional element were arc melted in a cold-crucible, non-consumable electrode arc furnace. The as-cast alloys are homogenized and then subjected to screening air-oxidation tests at 760°C in dry and humid air. Alloy compositions which exhibit good oxidation resistance after a 1000-hour exposure were studied by a thermo-gravimetric technique to determine the rate laws governing the oxidation. Also, the phase equilibria of the alloys were investigated after isothermal anneals at 750, 850, 1000, 1150, 1250, and 1370°C. Data are presented for screening oxidation tests on a number of alloys and weight gain versus time curves for $NbAl_3$, 53.5 Nb 36.5 Al 10 Ti, and 51 Nb 44 Al 5 Sn are reported. Phase equilibria data for $NbAl_3$-compound alloys with Ti and Zr additions are also presented. (auth)

24175 (UCRL-10119) INORGANIC MATERIALS RESEARCH DIVISION ANNUAL REPORT, 1961. (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 12, 1962. Contract W-7405-eng-48. 198p.

Progress is reported on investigations of fundamental physical and chemical characteristics of inorganic materials. Topics covered include: thermodynamics and high-temperature chemistry, solid-state physics and chemistry, reaction kinetics, inorganic chemistry, influence of microstructure on physical properties, electron microscopic studies of the influence of submicroscopic structure on physical properties, kinetics of dislocation mechanisms, high-temperature reactions, reactor materials engineering, and miscellaneous studies. (M.C.G.)

24176 (WADD-TR-60-749(Pt.II)) FACTORS AFFECTING THERMAL SHOCK RESISTANCE OF POLYPHASE CERAMIC BODIES. D. P. H. Hasselman and P. T. B. Shaffer (Carborundum Co., Niagara Falls, N. Y.). Feb. 1962. Contract AF33(616)-6806. 155p.

An investigation of the factors which affect the thermal shock resistance of polyphase ceramic systems was conducted using the model system zirconium carbide-graphite. The effect of graphite on the physical properties of the zirconium carbide is to increase the strain at fracture, thermal conductivity, and thermal diffusivity thereby increasing thermal shock resistance. Of significance is the observation that the presence of the graphite substantially reduces the damage which results from thermal shock. Explanations are given and suitable thermal shock damage resistance parameters are introduced. Emissivity was introduced as a variable affecting thermal shock resistance when radiation is the principal mechanism of heat transfer. A quantitative theory for thermal shock by radiation on heating was developed and confirmed experimentally. (auth)

24177 (WADD-TR-60-782(Pt.VIII)) VAPORIZATION OF COMPOUNDS AND ALLOYS AT HIGH TEMPERATURES. PART VIII. MASS SPECTROMETRIC STUDY OF GASEOUS SPECIES IN THE SYSTEM BORON–CARBON. G. Verhaegen, F. E. Stafford, M. Ackerman, and J. Drowart (Brussels. Université). Apr. 1962. Contract AF61(052)-225. 7p.

The molecules BC, B_2C, and BC_2 were identified. Their atomization energies were measured to be $D_0^0(BC) = 105 \pm 10$; $D_0^0(B_2C) = 260 \pm 10$; and $D_0^0(BC_2)^0 = 302 \pm 10$ kcal/mole. (auth)

24178 (WAL-TR-766-3/1-3) DEVELOPMENT OF REFRACTORY COMPOSITE MATERIALS SYSTEMS FOR SOLID PROPELLANT ROCKET MOTORS. Quarterly Progress Report No. 4. H. Leggett, R. J. Urode, H. S. Parechanian, and J. A. Stanley (Hughes Tool Co. Aircraft Div., Culver City, Calif.). July 20, 1961. Contract DA 04-495-ORD-3068. 77p. (HTC-61-78; AD-269975)

Difficulties encountered in deposition of metals from metal halide vapor dissociation were primarily caused by the vapor transport system and the difficulty in attaining a leak proof system. Efforts to circumvent and eliminate these difficulties showed extremely promising results. Depositions of Ta showed conclusively that the method is applicable for obtaining fine grained adherent coatings of TaC. The most successful carbide formations by direct union were those of Ta, Mo, and V. Excellent coatings of TaC were obtained when thin Mo coatings were used as an intermediate layer. Hard, adherent, Mo_2C coatings were produced at all temperatures above 3400°F. Coatings of VC, identified by x-ray diffraction, were produced at a temperature of 3400°F. The compounding of chemically bonded THO_2 and Mo wire-chemically bonded ZrO_2 composites was shown to be feasible. (auth)

24179 (AEC-tr-5174) STUDY OF THE SYSTEM CARBON–URANIUM–THORIUM. Quarterly Progress Report No. 4, October 1–December 31, 1961. M. Marchal and J. Trouve (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Translated by A. L. Monks (Oak Ridge National Lab., Tenn.) from report CEA-3677. Jan. 10, 1962. 31p.

Research results obtained during the period indicate that the interaction of ThC and graphite at 1200 to 1800°C is controlled by diffusion. The apparent activation heat of this interaction is 39 kcal/mole. The expansion coefficient of ThC_2 at 0 to 1000°C was found to be a constant, 8.46×10^{-6}. The thermal conductivity coefficient of ThC_2 was found to be near that of the monocarbide and that of UN. The thermal conductivity coefficient of ThC is markedly lower and near that of UO_2 in the same temperature region. (J.R.D.)

24180 (AEC-tr-5175) STUDIES OF THE URANIUM–THORIUM–CARBON SYSTEM. F. Benesovsky and E. Rudy. Translated by Gretchen R. Riese (Los Alamos Scientific Lab., N. Mex.) from Monatsh. Chem., 92: 1176-83(Dec. 1961). 13p.

The U–Th–C system was studied roentgenographically and metallographically in pressure-sintered, vacuum heated alloys. A division of the phase fields at 1700 and 1000°C was undertaken. The phases known in the boundary systems were established, but the high temperature forms of UC_2 and ThC_2 could not be stabilized. The complete miscibility of the monocarbide in the ternary was confirmed. The course of the lattice constants was in agreement with earlier data. In UC_2–ThC_2, even at 1900°, no continuous transition was found. At 1700° UC_2 dissolves about 30 mole % ThC_2 and conversely, ThC_2 also dissolves about 30 mole % UC_2. Thermodynamically, the thorium carbides are more stable than those of uranium; however, the stability is reversed in the presence of air. (P.C.H.)

24181 (AEC-tr-5177) THE IONIZATION POTENTIAL OF ATOMS AND THE MUTUAL SOLUBILITY OF METALS. A. A. Vorob'ev, P. A. Savintsev, and B. F. Ufimtsev. Translated from Izvest. Vysshikh Ucheb. Zavedenii, Fiz., No. 3, 233-4(1960). 3p.

It was found that in considering the mutual solubility of metals, the ionization potentials of the atoms must be taken into account together with other characteristics of the components. A slight difference between the ionization potentials of the components' atoms (Q_1–Q_2) facilitates formation of eutectic mixtures. An increase in (Q_1–Q_2)

results in unlimited mutual solubility of the components. When the difference (Q_1-Q_2) is large, intermetallic compounds may be formed. (M.C.G.)

24182 (AEC-tr-5203) STURCTURES OF NITRIDED ZONES UNDER THE OPTICAL AND ELECTRON MICROSCOPES. M. Koch. Translated for Atomic Power Development Associates, Inc., Detroit from Metalloberfläche, 13: 243-5(1959). 10p. (Includes original, 4p.).

The structure and characteristics of nitrided layers on steel were determined by the structure of the matrix in addition to the nitriding conditions and the composition of the steels. Metallographic investigations were carried out with optical and electron microscopes. (auth)

24183 (AEC-tr-5206) FISSION PRODUCT DIFFUSION AND SELF DIFFUSION IN HIGH TEMPERATURE NUCLEAR FUELS. R. Lindner, H. Matzke, and F. Schmitz. Translated by Gordon R. Love (Carnegie Inst. of Tech., Pittsburgh) from Z. Elektrochem., 64: 1042-5(1960). 11p.

The importance of self-diffusion and fission product diffusion to the application of high temperature nuclear fuels is discussed. The self diffusion of uranium in $UO_{2.0}$ was measured and the experimental activation energy was found to be 108 kcal/mole. The diffusion of radioactive fission inert gases Kr^{85} and Xe^{133} as well as Rn^{222} was determined in the oxides of uranium. The diffusion of Xe was also determined in UC and in ThO_2, and the diffusion of Rn was determined in ThO_2. The activation energy for xenon diffusion amounted to 49 kcal in $UO_{2.0}$; 20 kcal in U_3O_8; 45 kcal in UC; and 30 kcal in ThO_2. Krypton diffusion in $UO_{2.0}$ and U_3O_8 gave practically the same values, while the activation energy for radon diffusion in $UO_{2.0}$ (59 kcal), U_3O_8 (26 kcal), and ThO_2(51 kcal) is considerably greater in each case than that of the lighter inert gases. (auth)

24184 (AEC-tr-5213) INVESTIGATION OF FUEL ELEMENTS IN A HOT LOOP EXPERIMENT. C. B. von der Decken. Translated for Oak Ridge National Lab., Tenn. from Tech. Mitt. Krupp, 19: 173-81(1961). 27p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 5548.

24185 (AERE-Trans-884) INVESTIGATION OF PLATINUM–MOLYBDENUM ALLOYS. Hideo Nishimura. Translated by S. G. Brickley (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Nippon Kinzoku Gakkaishi, 22: 425-8(1958). 9p.

Pt–Mo alloys were arc-melted in an argon atmosphere. Their melting temperatures were measured, and x-ray analyses and microscopical study were carried out. From these results the equilibrium diagram was constructed. This alloy system consists of three kinds of solid phases, the Pt-rich solid solution α, an intermediate phase β corresponding to Pt–Mp compound, and the Mo-rich solid solution γ. The liquidus of β phase shows a maximum and on the Pt-side a peritectic reaction liquid + $\beta \rightleftharpoons \alpha$ occurs and on the Mo-side there exists a eutectic reaction liquid $\rightleftharpoons \beta + \gamma$. The electric resistance of Pt-rich alloys and the thermoelectromotive forces of Pt-(Pt–Mo) alloys were measured. The thermoelectromotive force shows a maximum value at about 3.5% Mo. (auth)

24186 MAXIMUM FIGURE OF MERIT OF THERMOELECTRIC MATERIALS. R. Simon (Battelle Memorial Inst., Columbus, Ohio). Advanced Energy Conversion, 1: 81-92(1961).

An estimate of the maximum figure of merit at optimum carrier concentration of a thermoelectric material is shown to be obtainable from the measured values of the Seebeck coefficient, the electrical conductivity, and the thermal conductivity for any extrinsic specimen of the material that is not too greatly overdoped. Effects of minority carriers, impurity scattering, and multiband conduction on this estimate are discussed. (auth)

24187 THERMODYNAMIC CHARACTERISTICS OF THE REDUCTION OF URANIUM OXIDES AND OF URANYL FLUORIDES BY CERTAIN REDUCING AGENTS. N. P. Galkin, U. D. Veryatin, V. I. Karpov, I. B. Braverman, and I. V. Fedoseev. Atomnaya Energ., 12: 531-3(June 1962). (In Russian)

In view of the importance of UO_2, used directly for fabricating fuel elements and for preparing UF_4, thermodynamic calculations were carried out on the reduction of the higher U oxides and of uranyl fluoride by NH_3, H_2, and CO. The isobaric-isothermal potential of the reduction reactions ΔZ_T were calculated in the temperature range from 373 to 1173°K, using data given by V. G. Glasov and V. N. Shalaginov (Zhur. Priklad. Khim., 34: 20(1961) No. 1). Results indicate that UO_2 is more easily reduced than U_3O_8. The ΔZ_T potential of NH_3 was found to be the highest among the reducing agents examined. The reducing ability of CO was found to decrease with increasing temperature, probably because of a shift in the $2CO + O_2 \rightleftharpoons 2CO_2$ reaction. UO_2F_2 cannot be reduced by CO but both H_2 and NH_3 reduce it easily. (TTT)

24188 VAPOR PRESSURE OF HOLMIUM METAL AND DECOMPOSITION PRESSURES OF HOLMIUM CARBIDES. Gene Felix Wakefield (Iowa State Univ. of Science and Tech., Ames). Dissertation Abstr., 22: 3433(Apr. 1962).

A method for the extension of the measurement of the vapor pressure of metals to include the range of pressure from 10 to 10^{-9} mm was devised. The method is applicable to metals which form a stable carbide in the range of temperature to be determined by the Langmuir method of measurement, and the use of the higher pressure region is limited only by the normal Knudsen restriction of a characterizable vapor species. The study of the lower pressure region was accomplished by the use of a large evaporation area surrounded by a condenser. The use of the condenser allowed the possibility of using a large evaporation area while the total weight supported by the balance was small, and thus allowed the sensitivity of the balance to be greater. The use of the normal Knudsen method in the higher pressure region was done as a check on the other techniques and this method was extended to still higher pressures by the use of a tube orifice, requiring a large Clausing factor correction. By the use of the above methods the vapor pressure of holmium metal was studied from 650 to 1750°C, so that the vaporization as well as the sublimation process could be observed. The data yielded the heat of sublimation (70.6 ± 0.5 kcal/mole), the heat of vaporization (64.7 ± 0.5 kcal/mole) and the heat of fusion (4.6 ± 0.6 kcal/mole). No evidence of a transformation was observed, but the scatter of the data in the temperature region immediately below the melting point of the metal is such that the existence of phenomena of this type is not excluded. The use of the carbide formation as a means to retain holmium vapor on the condenser necessitated the consideration of the thermal stability of the carbide of holmium, since the re-evaporation of any of the metal would lead to erroneous readings. To this end, it was determined that the carbide formed on the condenser is the dicarbide, and that at elevated temperatures, this can be decomposed to yield the metal and graphite. The equilibrium decomposition pressure of the dicarbide was measured by the Knudsen method. The sesquicarbide was prepared and the decomposition pressure determined by

the Knudsen method. The sesquicarbide decomposes to the dicarbide and holmium vapor as evidenced by the x-ray diffraction patterns of the residue of the decomposition pressure determinations. An attempt to measure the decomposition pressure of a third holmium–carbon compound, as indicated by Gschneidner, was unsuccessful due to the inability to identify the phases present in the decomposition products.

24189 PYROLYTIC GRAPHITE. Claude A. Klein. Intern. Sci. and Technol., No. 8, 60-5; (Aug. 1962).

A review is given on the physical, thermal, and mechanical properties, structure, and applications of pyrolytic graphite. Special attention is given to its potentialities and also the difficulties that impede its development. (P.C.H.)

24190 LINEAR THERMAL EXPANSION OF ALUMINUM OXIDE AND THORIUM OXIDE FROM 100° TO 1100°K. J. B. Wachtman, Jr., T. G. Scuderi, and G. W. Cleek (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc., 45: 319-23(July 1962).

The linear thermal expansion of single-crystal and polycrystalline aluminum oxide and polycrystalline thorium oxide was measured from 100 to 1100°K with an interferometric technique. The results are described by Grüneisen's equation using a Nernst-Lindemann energy function. (auth)

24191 THE BINARY SYSTEM CaO–Nb_2O_5. Mohammad Ibrahim, Norman F. H. Bright, and John F. Rowland (Dept. of Mines and Technical Surveys, Ottawa). J. Am. Ceram. Soc., 45: 329-34(July 1962).

The binary system CaO–Nb_2O_5 was shown to include three compounds: CaO · Nb_2O_5, which melts congruently at 1560°C; 2CaO · Nb_2O_5, which melts congruently at 1576°C; and 3CaO · Nb_2O_5, which melts incongruently at 1560°C. Three eutectic compositions occur at 6% CaO (1362°C), 23% CaO (1492°C), and 34% CaO (1535°C). These results were obtained by the cone-fusion technique. The compound 3CaO · Nb_2O_5 was shown to exist in two forms: type I, face-centered cubic with a = 7.978 A, having a superlattice with a = 23.934 A; and type II, orthorhombic (pseudotetragonal, distorted cubic) with a = 11.51 A, b = 11.10 A, and c = 15.98 A, having a pseudocell with a = 5.754 A, b = 5.551 A, and c = 7.990 A. The conditions controlling the formation of these two forms were not determinable from the experiments conducted. (auth)

24192 THERMAL CONDUCTIVITY OF ZIRCONIUM CARBIDE AT HIGH TEMPERATURES. R. E. Taylor. J. Am. Ceram. Soc., 45: 353-4(July 1962).

The thermal conductivity of zirconium carbide increases from 0.075 to 0.104 cal per cm-sec-°C during the temperature increase from 530 to 2100°C. Microscopic examination revealed numerous dark areas (probably voids) generally located in grain boundaries. Grain size was not appreciably affected by heat treatment and there was no detectable change in composition during the measurements. The electrical resistivity was measured from 20 to 970°C. The electrical resistivity values and the Wiedemann-Franz law were used to calculate the thermal conductivity contribution due to electrons from 20 to 970°C. The total conductivity is expressed as $k_t = k_e + k_p$, where subscripts e and p refer to electrons and phonons. The equation implies that the electron and phonon contributions are independent above room temperature, which is believed to be approximately true. However, k_p (obtained by substracting k_e from k_t) fails to follow the 1/T relation. (N.W.R.)

24193 ANISOTROPIC THERMAL EXPANSION OF SINGLE CRYSTALS OF THALLIUM, YTTRIUM, BERYLLIUM, AND ZINC AT LOW TEMPERATURES. R. W. Meyerhoff and J. F. Smith (Ames Lab., Ames, Iowa). J. Appl. Phys., 33: (Jan. 1962). (IS-292)

The anisotropic thermal expansion of the hexagonal elements, Tl, Y, Be, and Zn was measured. The temperature range for the Tl, Y, and Zn measurements was 4.2-273.2°K, while for beryllium the range was 77-273.2°K. Dimensional changes were detected by an interferometric technique, and the movement of the interference fringes was detected with a photomultiplier tube. From the measured values of $\Delta L/L_0$ the coefficients of thermal expansion and the c/a ratios of the metals were calculated as a function of temperature. A review of previous measurements of the thermal expansion of these metals is also included. (auth)

24194 THE AGING CHARACTERISTICS OF ALUMINUM ALLOYS. ELECTRON TRANSMISSION STUDIES OF Al–Mg–Si ALLOYS. G. Thomas (Univ. of California, Berkeley). J. Inst. of Metals, 90: 57-63(1961-62). (UCRL-9582)

Transmission electron microscope studies of an Al–Mg–Si alloy using the thin foil technique revealed many interesting features in the quenched and aged conditions. The concentration of vacancies annealed out to form dislocation loops in quenched specimens was about 3×10^{-4}, and the loop density about 10^{14}/cm^3. The zones which form first upon aging were resolved as needles on {110} with ⟨100⟩ growth directions; their density was about $2-5 \times 10^{15}$/cm^3. Prolonged aging revealed the aging sequence as a continuous change: needles-rods-plates: the rods being an intermediate form of the equilibrium plates of Mg_2Si. It is suggested that the change zones-rods occurs as a result of Mg–Si–vacancy groups diffusing to zones and that the final transformation to Mg_2Si is diffusionless. Age hardening in this alloy is due chiefly to chemical effects. (auth)

24195 DIFFUSION IN POLYMERS: OPTICAL TECHNIQUES. R. E. Barker, Jr. (General Electric Research Lab., Schenectady, N. Y.). J. Polymer Sci., 58: 553-70 (Apr. 1962).

Optical techniques were applied to study gas diffusion in poly(methyl methacrylate) (PMMA) and Lexan polycarbonate resin[poly(diphenyl-2,2-propane carbonate)] for temperatures ranging from 20°C to the glass transition temperatures. One method consists of observing the movement of a sharp colored diffusion boundary which occurs when certain radical scavenging gases (e.g., O_2, I_2) penetrate a polymer which has been exposed to high energy irradiation. The theoretical basis and physical interpretation of the moving boundary are discussed. In essence, the color center concentration (produced by irradiation) is greater than the normal equilibrium concentration of scavenger molecules in the polymer so that the latter are trapped before they can move very far inward. The result is approximately a step-function distribution of the remaining color centers. For O_2 penetration into Lexan below T_g, D (cm^2/sec) ≃ 0.014 exp {7100 cal/mole/RT}. This relation accounts for the effect of O_2 partial pressure on the penetration rate. For O_2 penetration into PMMA, below T_g, an activation energy of 10 kcal/mole was observed. A spectrophotometric method was used to measure the uptake of I_2 vapor in polycarbonate films. The data indicate a large change (~50 kcal/mole) in apparent activation energy near 114°C. Several possible applications of the moving boundary technique are mentioned and the results of its use to investigate the effect of stress on the diffusion rate in the polycarbonate are presented. Tensile stresses near the yield point produce a two-fold increase in D, whereas compressive stresses of comparable magnitude cause only a slight reduction. (auth)

24196 MEASUREMENTS ON THE DEGREE OF CROSSLINKING OF HIGH-CONVERSION POST-GELATION METHYL METHACRYLATE–METHYLENE DIMETHACRYLATE COPOLYMERS. Jesse C. H. Hwa (Rohm and Haas Co., Philadelphia). J. Polymer Sci., 58: 715-35 (Apr. 1962).

The degrees of crosslinking of three post-gelation high-conversion copolymers were measured by γ irradiation, extraction, and swelling experiments. The copolymers containing 0.2, 0.5, and 1.0 mole % of the crosslinker were prepared by suspension polymerization at 60°C with a free-radical catalyst. The degree of effective chemical crosslinking for the parent copolymers was calculated by correlating irradiation dose with extractables data after Shultz and the efficiencies of effective crosslinking were 40, 35, and 27% for the three copolymers, respectively. Based on related data by other workers, the low effective crosslinking efficiencies were due partly to incomplete polymerization of some crosslinkers on both ends and partly to wastage of crosslinks by intramolecular cyclization. On correlating the extractables data with the backbone molecular weight of the irradiated and extracted gels after Horikx, similar crosslinking efficiencies were obtained. A new technique was shown to obtain the latter information by hydrolyzing the copolymer with 80% sulfuric acid under specific conditions and reesterifying the hydrolyzed intermediate with diazomethane. The effective chemical crosslinking of the irradiated and extracted gels, $(\nu_e)_{ir}$, were calculated from the crosslinking efficiency and extractables data. The degree of effective crosslinking, $(\nu_e)_{sw}$, for the parent as well as the irradiated gels were calculated from swelling data by means of Flory's swelling equation. It was found that the apparent value of $(\nu_e)_{sw}$ for a given polymer decreased when a better solvent was used in the swelling. This finding was interpreted to be due to failure to correct the polymer-solvent interaction parameter χ_1, that was used in the swelling equation, for concentration dependence. The validity of the swelling equation was studied with respect to the prediction of $(\nu_e)_{sw}$. On comparing $(\nu_e)_{ir}$ with $(\nu_e)_{sw}$, the latter being determined in benzene ($\chi_1 = 0.439$), the ratios $(\nu_e)_{sw}/(\nu_e)_{ir}$ for the three parent copolymers were between 9 and 10. A large part of the discrepancy was believed to be due to the presence of permanent chain entanglements which acted like physical crosslinks. $(\nu_e)_{sw}/(\nu_e)_{ir}$ for the corresponding irradiated and extracted gels decreased sharply, and all appeared to approach an apparent common limit of about two at large irradiation doses. The theoretical limit should be one. Since the theory of rubber elasticity by James and Guth would require the limit of $(\nu_e)_{sw}/(\nu_e)_{ir}$ to be 0.5 by the present scheme, Flory's theory on which the swelling equation was based seemed to be preferable. However, Flory's theory could not be distinguished from a slightly different theory by Hermans. (auth)

24197 THE EFFECT OF THE COOLING PROCESS DURING ROLLING ON THE AMOUNT OF THE RESIDUAL AUSTENITE. E. S. Tovpenets, F. I. Ivanov, and M. A. Gintar' (Polytechnic Inst., Donets). Metalloved. i Termichesk. Obrabotka Metal., No. 5, 8-12(May 1962). (In Russian)

The stability of supercooled austenite in various types of steels was studied under accelerated cycled cooling conditions. The Cr–Ni–Mo steel was found to be most stable while the Cr–W–Si steel exhibited the least amount of stability. Cycled accelerated annealing, including supercooling to 250°C, ensured a more complete decomposition of the supercooled austenite; a single cycle with an extended soaking step at 650° stabilized the austenite. The precision of the measurements depends greatly on the standards employed. Unneeded, long soaking periods for several tens of hours at 200 to 300 and at 640 to 660°C, used for forging, usually results in a reduction of the quality of the steel as it increases the strength of the residual austenite. (TTT)

24198 NON-AGING LOW-CARBON STEEL FOR ELECTROTECHNICAL APPLICATIONS. N. P. Zhetvin, V. P. Tunkov, and A. I. Paisov. Metalloved. i Termichesk. Obrabotka Metal., No. 5, 21-2(May 1962). (In Russian)

The low-carbon electrotechnical steel is one of the most important materials for the construction of experimental devices. It presents a tendency toward magnetic aging, as shown by the increase of its coercive strength. This phenomenon is due to the separation and the coalescence of Fe nitrides, consisting primarily of the metastable $Fe_{16}N_2$. This can be best prevented by binding the N in the form of a stable Al nitride; however, introduction of excessive amounts of Al causes difficulties in the melt. It was found that addition of Si in an amount resulting in a final concentration in the alloy of 0.3 to 0.5% represents an excellent method for fabricating a low-carbon (less than 0.03%) and low-sulfur (less than 0.025%) steel which is well suited for use in the electrotechnical industry. (TTT)

24199 EFFECT OF CARBON CONTENT OF STEELS ON THE DIFFUSION RATE OF CHROMIUM. E. P. Mogilevskii (Central Scientific Research Inst. of Heavy Machinery). Metalloved. i Termichesk. Obrabotka Metal., No. 5, 35-6(May 1962). (In Russian)

According to previous data, the diffusion of Cr increases strongly with increasing temperature. This problem was studied by exposing Armco iron and steels with C contents of 0.03, 0.17, 0.28, 0.41, and 0.73% together with metallic Cr to temperatures ranging from 1000 to 1200°C in a vacuum furnace at a pressure of 10^{-2} mm of Hg for periods of 4, 8, and 12 hours. For comparison, similar tests were carried out with a powder mixture of 60% Cr, 39% Al_2O_3, and 1% NH_4Cl. The tests with Cr had the advantage of a better utilization of the heat flow through the metallic medium which did not contain low-conducting admixtures as the powder. Increase of the C content affected the diffusion rate to a greater extent in the case of the metallic Cr. At the higher experimental temperatures a carbide phase was formed in the steels containing C, impeding the diffusion of Cr. Use of metallic Cr in vacuum diffusion tests yields a thick penetration layer only in steels containing not more than 0.2% C and at temperatures of 1100°C or higher. (TTT)

24200 EFFECT OF Re ON Co–Cr–Mo–Ni ALLOY PROPERTIES. E. M. Savitskii, V. A. Sol'ts, and M. A. Tylkina (Central Scientific-Research Inst. of Ferrous Metals and Baikov Inst. of Metallurgy, USSR). Metalloved. i Termichesk. Obrabotka Metal., No. 6, 10-13(June 1962). (In Russian)

Diffusion of 10% Re into cobalt-base alloy (0.12% C, 0.004% S, 0.51% Si, 2.12% Mn, 16.17% Ni, 21.21% Cr, 6.83% Mn, 12.84% Fe, and 40.16% Co) improved the strength (after aging the hardness is 60 to 64 and ductility is 260 to 280 kg/mm^2) without impairing its magnetic and corrosion properties. (R.V.J.)

24201 YTTRIUM. F. A. Schmidt and E. D. Gibson, comp. (Ames Lab., Ames, Iowa). Metals Handbook, 1: 8th ed., (Jan. 1961). (IS-222)

A brief review of the uses, electrical, mechanical, and physical properties, structure, and fabrication of yttrium is given. 18 references are included. (P.C.H.)

24202 DEFORMATION OF URANIUM DURING ALPHA/BETA CYCLES UNDER SMALL STRESSES AND A QUANTI-

TATIVE INTERPRETATION OF THE MECHANICAL WEAKNESS OF METALS UNDERGOING PHASE TRANSFORMATIONS. R. H. Johnson and G. W. Greenwood (Berkeley Nuclear Labs., Gloucestershire, Eng.). Nature, 195: 138-9(July 14, 1962).

A quantitative theory is proposed to explain the extent of deformation occurring during α/β cycling of uranium and the observations of others on iron. From the theory and the experimental results, the value of Y, the yield stress of the α phase at the transformation temperature, is deduced to be 600 g/mm^2. Thus, close correlation between theory and experiment was obtained. An equation describing the strain ϵ_n occurring after n complete cycles under small applied stress σ is given. (P.C.H.)

24203 EFFECTS OF IRON OXIDE ON Zr MASS SINTERING AND ZrO_2 STABILIZATION PROCESSES. E. K. Keler and A. B. Andreeva (Inst. of Chemistry of Silicates, Academy of Sciences, USSR). Ogneupory, No. 4, 184-92 (1962). (In Russian)

Admixtures of Fe_2O_3 to magnesium-stabilized ZrO_2 reduces the sintering temperature by 200 to 300°C and can be used as a mineralizer in the preparation of ZrO_2 materials at 1400°C. At 1500°C the MgO forms a solid solution with ZrO_2, becoming partially cubical and partially monoclinic in structure. At 1400°C magnesium ferrite does not react with ZrO_2. The admixture of Fe_2O_3 to a zirconium–calcium mixtures forms a solid solution of ZrO_2–CaO at 1400°C with x-ray diffraction lines shifted (in comparison to pure solution) towards reduced intraplane distances. Additions of Fe_2O_3 lead to disintegration of solid solutions of ZrO_2 with CaO and MgO. (R.V.J.)

24204 MAGNETIC STRUCTURES OF THULIUM. W. C. Koehler, J. W. Cable, E. O. Wollan, and M. K. Wilkinson (Oak Ridge National Lab., Tenn.). Phys. Rev., 126: 1672-8 (June 1, 1962).

Neutron diffraction studies on polycrystalline and single-crystal specimens of thulium were made at room temperature to 1.3°K. The results are interpreted by a method exhibiting explicitly the Fourier components of the distribution of magnetic moments on the lattice sites. At about 56°K, the Néel temperature, a simple oscillating z-component-type antiferromagnetic structure is developed. At approximately 40°K, nonzero Fourier coefficients of overtones of the fundamental observed at higher temperatures are first detected. At 4.2°K, the magnetic structure of thulium is a type of antiphase domain structure in which several layers of moments parallel to the $+a_3$ direction are followed by several layers in which the moments are oppositely directed. The sequence in thulium is −4, +3, −4, +3, ... etc. Each atom has, within the precision of the experiments, an ordered moment of $7\mu_B$, and the ferrimagnetic structure has a net moment, parallel to the c axis, of $1\mu_B$ per atom. The fundamental period of the modulation remains constant over the whole range of temperatures at a value corresponding to 3.5 a_3 periods. The scattering amplitude of thulium is $b_{Tm} = (0.69 \pm 0.02) \times 10^{-12}$ cm. (auth)

24205 POLYMORPHIC TRANSITION IN LiH. David P. Schumacher (Tufts Univ., Medford, Mass.). Phys. Rev., 126: 1679-84(June 1, 1962).

The transition pressure at which LiH would be expected to go from a NaCl to a CsCl structure is calculated to be 3050 and 3800 kg/cm^2, using two potential functions. Transition pressures for KCl and RbI are 22,500 and 5400 kg/cm^2, respectively, which agree with observed values. (auth)

24206 FOCUSING CONDITIONS FOR ELASTIC ATOMIC COLLISIONS IN GRAPHITE. M. Balarin (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Phys. status solidi, 2: 60-72(1962). (In German)

The focusing conditions for elastic atomic collisions in graphite were derived. The focusing is only possible within the plane of the (A) direction ($(11\bar{2}0)$). The smallest collision diameter of a carbon atom, in which the focusing can occur, is $D_{kr} = 2a/3$ (a = 1.42 Å–atomic distance). An estimation was made of the conditions under which the aperture angle and the pulse density were focused in collisions not in the vicinity of the axis. In opposition to the face-centered cubic metals, the indirect focusing is meaningless in the graphite lattice layer. The energy threshold value for the focusing is of the order of several 10's of ev. (tr-auth)

24207 THE MANUFACTURE OF DYEABLE POLYTETRAFLUOROETHYLENE WITH RADIOCHEMICAL GRAFT COPOLYMERIZATION. J. Dobó, A. Somogyi, and E. Lakner. Plaste u. Kautschuk, 7: 393-5(Aug. 1960).

Polytetrafluoroethylene cannot be dyed by the usual methods. However, if a dyeable polymer is deposited on the Teflon foil, a foil is obtained which retains the good characteristics of Teflon and can be dyed in various dye baths. Such a dyeable foil can be deposited on Teflon by graft polymerization with a suitable monomer after irradiation with a 220-kv, 15 mamp x-ray tube or the γ rays from a 60-c Co^{60} source. The following monomers were used: styrol, methyl methacrylate, vinyl acetate, and vinyl pyridine. Vinyl acetate requires the least irradiation and provides the best dyeability. The shade and intensity of the color depend on (a) the percentage of grafted copolymer, (b) the thickness, (c) the time of immersion in the dyeing bath, and (d) the temperature of the dyeing process. (OID)

24208 HEAT CONDUCTION OF REFRACTORY BORIDES, CARBIDES AND NITRIDES. S. N. Lvov, V. F. Nemchenko, and G. V. Samsonov (Kherson State Pedogogical Inst. and Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Poroshkovaya Met., No. 6, 70-4(1962). (In Russian)

The heat conduction of borides of titanium, vanadium, and chromium, the carbides of these metals, as well as the nitrides of titanium, zirconium, hafnium, vanadium, niobium, tantalum, chromium, and molybdenum were measured. The results are discussed from the standpoint of the conceptions of the electronic and crystalline structure of compounds of transition metals with non-metals. (auth)

24209 DETERMINATION OF THE HEAT CONDUCTION COEFFICIENT OF GRAPHITE AT HIGH TEMPERATURES IN VACUUM. S. P. Rusin and E. N. Marmer (All-Union Inst. of Scientific-Research on Electrothermal Equipment, USSR). Poroshkovaya Met., No. 6: 75-8(1962). (In Russian)

A description is given of the set-up and procedure of determining the heat conduction coefficient. The heat conduction coefficient of brand "A" and "B" graphites was determined over a temperature range of 1300 to 2400°C. (auth)

24210 CERAMIC PROPERTIES OF THE SYSTEM ZrO_2–SiO_2. R. Pampuch. Prace Inst. Hutniczych, 5: 229-37(1961). (In Czech)

Sintered ZrO_2 with small additions (5 to 10%) of SiO_2, in general have better thermal shock resistance than sintered zirconia stabilized with CaO or MgO. The favorable effect of SiO_2 on properties of sintered ZrO_2 is largely due to inhibition of grain growth processes caused by solid phase reactions of both substrates. Decisive improvement of high temperature mechanical properties is obtained at 10% SiO_2 content which provides continuous distribution of $ZrO_2 \cdot SiO_2$ phase in the sintered material. Owing to absence of cracking, in the presence of 10% additions of SiO_2 (even with

comparatively low porosity of 10%) there is no hysteresis loop during heating and cooling of the sintered material and therefore there are no irreversible dimensional changes after firing or repeated fatigue cycles. Owing to unfavorable effect of SiO_2 additions on sintering of ZrO_2 it is recommended to use the latter in the form of a powder obtained by igniting $ZrOCl_2$ at 700 to 800°C in the presence of HCl. In these conditions transient stabilization of the low-temperature reactive tetragonal form of ZrO_2 gives a reactive raw powder and, after sufficiently longer holding at the sintering temperature, a reasonably high density of the sintered material. (auth)

24211 WAVELENGTH PERTURBATION IN ELECTRON DIFFRACTION FOR MAGNETIC ANALYSIS. S. Yamaguchi (Inst. of Physical and Chemical Research, Tokyo). Rev. Sci. Instr., 33: 690-1(June 1962).

Electron diffraction experiments were made on a sharp edge of an iron single crystal forming a narrow gap with a magnetized steel razor blade. The results for two different wavelengths show that only the (OkO) diffraction spots are split radially and hence the magnetic induction of the crystal is parallel to the [100] axis. The magnetic induction was determined to be $\sim 2 \times 10^4$ gauss, in agreement with the known saturation induction of iron. (D.L.C.)

24212 THE INFLUENCE OF DISTORTIONS OF CRYSTAL LATTICES IN PARTIALLY ORDERED BINARY ALLOYS WITH DIFFERENT SIZED ATOMS ON THE INTENSITY OF SCATTERED X RAYS. A. A. Smirnov, E. A. Tikhonova, and A. V. Chalyi (Inst. of Metallurgy, Academy of Sciences, Ukrainian SSR, Kiev). Soviet Phys.-Solid State, 4: 55-9(July 1962).

The dependence of the intensity of scattered x rays on the composition and the degree of long-range order, in binary partially ordered alloys with distorted fcc lattices, was investigated. The character of the distortion-caused dependence of the regular x-ray reflections on the degree of long-range order was explained. It was shown that the distortions might enhance superstructure lines in a certain concentration interval. (auth)

24213 MECHANISM OF SCATTERING BY IONIC IMPURITIES IN Bi_2Te_3. B. A. Efimova, E. V. Kel'man, and I. S. Stil'bans (Inst. of Semiconductors, Leningrad). Soviet Phys.-Solid State, 4: 108-11(July 1962).

Over the range 80 to 600°K, measurements are made of the temperature dependence of the mobility of holes and electrons in polycrystalline samples of Bi_2Te_3 with different current carrier concentrations. It is shown that the relaxation time in the case of impurity scattering depends on neither temperature nor carrier energy. The scattering cross section for ionic impurities is calculated, and a comparison is made between the obtained results and theoretical predictions. The temperature dependence of the mobility of holes and electrons during thermal scattering is determined as $U_h \sim T^{-2.12}$ and $U_e \sim T^{-1.78}$. (auth)

24214 INVESTIGATION OF WORK HARDENING OF COPPER BY A NUCLEAR MAGNETIC RESONANCE METHOD. V. S. Pavlovskaya and Yu. S. Stark (Moscow Steel Inst.). Soviet Phys.-Solid State, 4: 205-7(July 1962).

Work hardening of copper was investigated by a nuclear magnetic resonance method using the Cu^{63} isotope absorption line. It was shown that all changes in the absorption line could be explained by first order quadrupole interactions. Electric field gradients were estimated at nuclear sites. From these data, the distortion of the unit cells of the crystal lattice was determined for different degrees of work hardening. (auth)

24215 STEEL FOR PRESSURE VESSELS FOR POWER REACTORS. E. Zastrow. Stahlbau, 29: 329-33(Nov. 1960). (In German)

Both gas-cooled and water-cooled reactors place on the steel pressure vessel rigid requirements with respect to the design, radiation stability, γ-induced internal stresses, and inability to, or difficulty in, repairing the vessel once it is installed. The factors to be considered in the selection of a given steel for a pressure vessel are reviewed, and the properties of steels previously used for this purpose are tabulated. The studies being made at present to improve the desirable properties of steels for pressure vessels are briefly summarized. The corrosion stability and irradiation stability of steel are discussed. Neutron activation of the steel is also briefly reviewed. (J.S.R.)

24216 LIQUID METAL FUEL CONSTITUTIONS. III. LIQUIDUS CURVES OF THE BISMUTH-FISSION PRODUCTS SYSTEMS. D. G. Schweitzer and J. R. Weeks (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Soc. Metals, 54: 185(1961).

The solubilities of the long-lived fission products in liquid Bi were measured at temperatures from 300 to 700°C. Solubility curves are given for Sr, Ba, Y, La, Ce, Pr, Nd, Sm, Ge, Zr, Mo, Te, Ru, Rh, and Pd. (auth)

24217 THE CONSTITUTION OF URANIUM-RICH URANIUM–SILICON–ALUMINUM ALLOYS. Guenter Petzow and Ingard Kvernes (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 248-56(Apr. 1962). (In German)

U–Si–Al, the U-rich region extending to the quasibinary section U_3Si_2–UAl_2 was investigated. The results given are based on thermal, microscopical and x-ray measurements. The melting surface, 3 isothermal sections at 950, 850, and 650°C and 4 temperature-concentration sections are described. Four four-phase transformations were found in the regions examined and are represented by the following equations: melt = γ-uranium + U_3Si_2 + UAl_2 (960°C), γ-uranium + U_3Si_2 = U_3Si + UAl_2 (890°C), γ-uranium = β-uranium + U_3Si + UAl_2 (730°C), and β-uranium = α-uranium + U_3Si + UAl_2 (580°C). While the U solid solution fields extend only slightly into the ternary region, the intermetallic phases U_3Si, U_3Si_2, and UAl_2 show no extension at all into this direction. (auth)

24218 PROPERTIES OF BERYLLIUM. (Hausner (Henry H.), New York). [1962]. 19p. $1.00(General Astrometals Corp., Yonkers, N. Y.).

Twenty-four tables are compiled which represent the best available data on the structure and physical, mechanical, and chemical properties of beryllium. (P.C.H.)

24219 CONTINUOUS RELEASE OF FISSION GAS FROM UO_2 DURING IRRADIATION. R. M. Carroll (Oak Ridge National Lab., Tenn.). p.110-20 of "Symposium on Radiation Effects in Refractory Fuel Compounds." Special Technical Publication No. 306. Philadelphia, American Society for Testing and Materials, 1961.

Fission gas released from UO_2 during irradiation was measured by gamma ray spectrometry. Iodine, xenon, and krypton were released by diffusion above 600°C UO_2 temperature. About 45% of the 133 isobar and 80% of the 135 isobar emerged in the form of iodine (or a precursor) for the temperature range 700 to 1000°C. The remainder was released as xenon and by diffusion. Fission gas was emitted in bursts when the UO_2 was heated or cooled. The increase in temperature of an already hot fuel specimen resulted in a temporary overshoot of diffusion release but no trapped gases were released. The cooling bursts released stores

of trapped gases. The amounts of Xe^{133} and Xe^{135} released during the cooling burst had a constant relation to the steady state diffusion release before the fuel was cooled. This burst may be due to a phase change of a higher oxide region of the UO_2. The ratio in which radioactive isotopes are emitted from the UO_2 is derived for diffusion, recoil, and trapped gas release. The measured ratios confirmed that the cooling bursts were by a different release mechanism than the steady state release. (auth)

24220 CONCRETE FOR RADIATION SHIELDING. Compilation No. 1. Second Edition. Detroit, American Concrete Institute, 1962. 177p. (NP-11837) $4.50.

Eleven papers are included; separate abstracts have been prepared for these plus a discussion on one of the papers. Information is given on the use of concrete for shielding nuclear radiation and the calculation of proportions and properties of various heavy concretes. (N.W.R.)

24221 CONCRETE FOR RADIATION SHIELDING. Edwin J. Callan (Concrete Research Div., Waterways Experiment Station, Jackson, Miss.). p.3-30 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit American Concrete Institute, 1962.

Concrete for shielding nuclear radiation is discussed, with emphasis on factors related to concrete technology and cost. The types of radiation and mechanics of radiation shielding are presented briefly, and data regarding concrete for shielding are reviewed. Tables and curves of concrete thickness required for shielding are given for both ordinary and heavy concrete. Problems involved in the use of special concrete are discussed. An outline of a procedure for designing concrete shielding is presented. (auth)

24222 PROPERTIES OF NUCLEAR SHIELDING CONCRETE. James O. Henrie. p.31-40 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

General shielding requirements are discussed with particular emphasis on fast neutron shields. Concrete materials which are effective in meeting the requirements are outlined and the basic principles involved are explained. The concrete mix, type and source of materials, and strength properties of the shields of four similar reactors are compared. Effects on concrete setting time and strength of adding boron in the form of mineral colemanite and borocalcite and the counter effects of calcium chloride are described. (auth)

24223 ABSORPTION BY CONCRETE OF X-RAYS AND GAMMA-RAYS. B. E. Foster (National Bureau of Standards, Washington, D. C.). p.41-59 of "Concrete for Radiation Shielding. Compilation No. 1, Second Edition." Detroit, American Concrete Institute, 1962.

The mechanism of the absorption of x-rays and gamma-rays by various shielding materials is discussed. A review of the experimental work to establish data with which concrete barriers may be designed is presented. A brief discussion of the methods used in protective barrier design is included and the relative merit of several barrier materials, including heavy concretes, is discussed. (auth)

24224 HIGH-DENSITY CONCRETE FOR SHIELDING ATOMIC ENERGY PLANTS. Harold S. Davis (General Electric Co., Richland, Wash.). p.61-73 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Concrete properties required for gamma ray absorption and neutron attenuation are outlined. Fixed water content and its role in slowing down fast neutrons are explained.. Grouts and mortars, heavy aggregate properties, and use of boron are also covered. Placement methods evaluated include: conventional, pumping, prepacking, and puddling. Formwork problems including dimensional tolerances are outlined, and shields made of high-density concrete block are described. Tabulated data cover costs of materials as well as finished shielding structures. (auth)

24225 HIGH-DENSITY CONCRETE FOR SHIELDING ATOMIC ENERGY PLANTS. D. Campbell-Allen (Univ. of Sydney) and Bruce A. Lamerton. p.75-7 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Comments are made on the use of ilmenite sand as a fine aggregate for producing high-density concretes and on the cost of placing high-density concretes. The construction cost is more a function of placement difficulty than method. Neutron attenuation properties of several types of concretes are given. The effect of heat on fast neutron attenuation in concretes is discussed. (N.W.R.)

24226 PROPERTIES OF HIGH-DENSITY CONCRETE MADE WITH IRON AGGREGATE. Harold S. Davis (General Electric Co., Richland, Wash.), Frederick L. Browne, and Harry C. Witter. p.79-100 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Data are presented on the physical properties of several types of mortar and concrete made with iron-bearing aggregate for use in radiation shields. Heavy aggregates used in this investigation included steel punchings, fine steel shot, ferrophosphorus, magnetite, and limonite. Concrete made with natural heavy aggregates had densities of from 185 to 225 lb per cu ft. One type of concrete made with steel punchings and limonite weighed 273 lb per cu ft. Both the prepacked method and conventional methods were used for fabricating concrete specimens. The results of tests performed on several types of heavy mortars made with fine sand are also reported. Data obtained at elevated temperatures are presented, as well as data obtained from standard tests on aggregate, concrete, and mortar. The data and experience obtained during this investigation demonstrate that concrete suitable for radiation shields can be made with iron-bearing aggregates by either the prepacked or conventional methods of construction. (auth)

24227 HIGH-DENSITY CONCRETE MADE WITH HYDROUS-IRON AGGREGATES. Harold S. Davis and Orville E. Borge. p.101-7 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Data are presented on the physical properties of a high-density concrete tested under standard conditions and after heating at temperatures of 85, 200, and 350°C. The concrete has a density of 218 lb per cu ft and a fixed water content of about 4.3% at 85°C, which makes it a desirable material for biological shields around atomic power reactors. Computed values of attenuation lengths are included for fast neutrons and gamma radiation. (auth)

24228 HEAVY STEEL–AGGREGATE CONCRETE. E. I. Fiesenheiser and B. A. Wasil (Illinois Inst. of Tech., Chicago). p.109-18 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

An experimental study of various mix proportions for heavy concrete is described and a proportioning procedure for concrete of given strength and density is explained. The primary object of the investigation was to determine a procedure for the improved proportioning of mixes using steel punchings as coarse aggregate with steel shot of

varying size as fine aggregate. First, the individual ingredients were investigated, then, the optimum mixture. Various heavy concrete mixes were made and strength tested at 7, 14, and 21 days. Tests results are interesting in that they indicate a possible conclusion that the strength of this concrete is proportional to its density, the water-cement ratio being only one of the factors involved in determining the density. This suggests the generalization that, in the plastic range, the strength of any concrete of given ingredients is proportional to its density. (auth)

24229 PROPERTIES OF HEAVY CONCRETE MADE WITH BARITE AGGREGATES. L. P. Witte and J. E. Backstrom (Bureau of Reclamation, Denver). p.119-42 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Results of tests performed on barite (barium sulfate) to determine its potential value as an aggregate in conventional and prepacked concrete are reported. The concretes developed were tested under a variety of conditions to determine their physical, chemical, and structural characteristics. Barite aggregate behaves in concrete similarly to an ordinary crushed aggregate such as limestone or basalt, and no special problems were encountered in selecting and proportioning the constituents of the concretes. Exceptionally high compressive strengths were developed by conventional barite concrete. Prepacked barite concretes did not develop these high strengths. Coefficient of thermal expansion is approximately twice that of concrete containing a good natural aggregate similar to that used in Grand Coulee Dam. Values of specific heat, thermal conductivity, and diffusivity are approximately one-half those obtained with the natural aggregate concrete. Concretes having densities of as much as 232 lb per cu ft were obtained. Concrete of high density is desirable for shielding in certain areas of atomic plants. Barite might also serve as riprap for bank protection where weight is desirable. (auth)

24230 MAGNETITE IRON ORE CONCRETE FOR NUCLEAR SHIELDING. J. O. Henrie (North American Aviation, Inc., Downey, Calif.). p.143-52 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Crushing and handling of the magnetite iron ore, which was used as the aggregate for a dense shielding concrete are discussed, and the physical properties and costs of magnetite ore concrete are compared to those of other concretes. The mix used had a compressive strength of 4000 psi in 10 days. The methods used in fabricating shielding block are described. Recommendations for producing a low cost, relatively high density shielding concrete are made. The shielding block used (9 × 9 × 18 in. nominal) had a density of 3.7 g per cu cm or 230 lb per cu ft and cost $163.50 per cu yd. The dimensions of the block were quite uniform, having a standard deviation of approximately 0.015 in. (auth)

24231 PROPORTIONING OF MIXES FOR STEEL COARSE AGGREGATE AND LIMONITE AND MAGNETITE MATRIX HEAVY CONCRETES. David L. Narver, Jr. (Holmes and Narver, Inc., Los Angeles). p.153-64 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Structural concrete of heavy weight, utilizing limonite and magnetite ores as fine aggregate and graded steel scrap as coarse aggregate is discussed. Criteria are presented for proportioning a concrete mix for specific unit weight as well as a specific compressive strength. Employing various combinations of conventional coarse aggregate and steel aggregate and either conventional limonite or magnetite fine aggregate, concrete can be produced with a density from 140 to 330 lb per cu ft. Compressive strength of 3000 psi is reported to be obtainable without difficulty. (auth)

24232 INTERNAL SHIELDING CONSTRUCTION AT SHIPPINGPORT NUCLEAR POWER PLANT. L. Earl Tabler, Jr. p.165-70 of "Concrete for Radiation Shielding. Compilation No. 1. Second Edition." Detroit, American Concrete Institute, 1962.

Concrete walls 4 to 6 ft thick, constructed inside 50-ft diameter steel chambers at the Shippingport power plant, serve as shielding against radioactivity. The unusual construction practices occasioned by limited access to chamber interiors are described. Concrete was a standard density, 3000-psi mix made with Type IS cement. (auth)

Radiation Effects

Refer also to abstracts 24455, 24458, 24460, 24493, 24607, 24608, 24609, 24610, 24611, 24613, 24614, 24615, 24616, 24617, 24618, 24619, 24623, 24632, 24636, 24637, 24638, 24639, 24640, 24641, and 24642.

24233 (57GL77) BIBLIOABSTRACT ON RADIATION EFFECTS. W. R. Langdon and R. L. Thompson (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Mar. 1957. 83p.

A bibliography containing 232 references is presented on radiation effects on materials. Subject and author indexes are presented for the annotated references. The references contain information on radiation effects on the chemical, electrical, mechanical, metallurgical, optical, thermal, and crystal properties of the materials along with references on dosimetry and counters. (N.W.R.)

24234 (ARL-62-343) THEORETICAL AND EXPERIMENTAL STUDIES CONCERNING RADIATION DAMAGE IN SELECTED COMPOUND SEMI-CONDUCTORS. Lee W. Aukerman, Eugene M. Baroody, Ronald D. Graft, and T. S. Shilliday (Battelle Memorial Inst., Columbus, Ohio). May 1962. Contracts AF33(616)-3747 and AF33(616)-8064. 56p.

The effects of energetic particles on the electrical and optical properties of various semiconducting compounds were investigated. Emphasis was placed on n-type GaAs irradiated with fast neutrons and 1-Mev electrons. The effects of fast-neutron irradiation on the performance of Ge, Si, and GaAs Esaki diodes were also observed and analyzed. GaAs irradiated with fast neutrons has apparent energy levels introduced at $E_c - 0.085$ ev, $E_c - 0.47$ ev, and $E_v + 0.61$ ev. Similar material irradiated with 1-Mev electrons has an apparent level at about $E_c - 0.13$ ev. Fast-neutron irradiation of InP introduces a level at about $E_c - 0.285$ ev. Annealing studies on neutron and electron irradiated GaAs permitted a direct comparison of the two types of damage. Optical-absorption experiments on neutron-irradiated GaAs, CdTe, and CdS as well as electron irradiated GaAs also allow a comparison. The results are discussed in terms of the inhomogeneous type of damage expected to occur in neutron-irradiated materials. Theoretical consideration is given to scattering cross sections for atomic-penetration problems. Approximate analytical relationships are derived in terms of an energy-dependent parameter, $\gamma = (-d \ln V/d \ln r)_{r=c}$, where c is the distance of

closest approach in a head-on collision. Results expressed in this manner are insensitive to the precise form of the repulsive potential, V(r). Discussions of the Bohr-Nielsen range-energy equation and the focusing effects resulting from the lattice structure are also presented. (auth)

24235 (CRFD-1084) POST IRRADIATION EXAMINATION OF THE FIRST SAP CLAD UO_2 FUEL ELEMENTS IRRADIATED IN THE X-7 ORGANIC LOOP. R. D. MacDonald and K. Aspila (Atomic Energy of Canada Ltd., Chalk River, Ont.). Feb. 1962. 15p. (AECL-1506; Exp-NRX-5806)

Seven fuel elements composing the first in-reactor test at Chalk River of SAP sheathing were irradiated in the X-7 organic loop. Activity, denoting a fuel failure, was detected in the loop coolant immediately after reactor start up; the fuel string was consequently removed from the loop nine hours later. Leak tests disclosed that five of the seven elements were defective. Inspection of the specimens showed essentially no change in element dimensions. Practically no organic fouling film was observed on the surface of the SAP cladding; organic coolant was found inside four of the defective elements. The appearance of the UO_2 fuel was consistent with the irradiation time and the heat ratings achieved during the test. (auth)

24236 (DP-669) RELAXATION OF TORSIONAL STRESSES IN STAINLESS STEEL DURING IRRADIATION. Richard E. Schreiber (Du Pont de Nemours (E. I.) & Co, Savannah River Lab., Aiken, S. C.). Apr. 1962. Contract AT(07-2)-1. 16p.

The shear stresses in torsionally loaded specimens of 304 stainless steel relaxed by as much as 7,500 psi when irradiated in a nuclear reactor at a temperature below 100°C. The maximum exposure was 10^{21} fast neutrons per square centimeter. The initial shear stresses of about 20,000 psi relaxed approximately 30%, which was the same as the relaxation previously reported for specimens of 304 stainless steel that were loaded in tension and irradiated at the same conditions of maximum shear stress, temperature, and exposure to fast neutrons. At an initial shear stress of 10,000 psi, the 20% relaxation in the torsional specimens was less than half that in the corresponding tensile specimens. At 5,000-psi shear stress in torsion, the stress relaxation was too small to be measured reproducibly. (auth)

24237 (DP-709) IRRADIATION OF A U–2% Zr FUEL TUBE IN THE VBWR. Henry C. Quigley (Du Pont de Nemours (E. I.) & Co., Wilmington, Del.). Apr. 1962. Contract AT(07-2)-1. 18p.

A coextruded 2-inch-diameter tubular fuel element of U-2 wt % Zr alloy clad with Zircaloy-2 was irradiated in the Vallecitos Boiling Water Reactor to 1280 Mwd/t burnup with a maximum core temperature of 433°C. The purpose of this irradiation was to determine the dimensional stability of the alloy under conditions approaching those contemplated for D_2O-cooled power reactors. Successive dimensional measurements revealed a sharp change in swelling rate between 700 and 1280 Mwd/t burnup. The amount of swelling increased during this interval from 0.8 to 3.6% (0.7% final cladding strain). This test indicated that the dimensional stability of the U-2 wt % Zr alloy is inferior to that of unalloyed U irradiated under similar conditions. (auth)

24238 (GEMP-12A) HIGH-TEMPERATURE MATERIALS PROGRAM. Progress Report No. 12, Part A. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 15, 1962. Contract AT(40-1)-2847. 29p.

Studies are being made to define the physical and mechanical properties of irradiated BeO as they are influenced by purity, additives, grain size, density, and porosity at various irradiation temperatures and dosages. Post irradiation measurements on composition series specimens, studies of effects of preferred orientation, and irradiations of the grain size-density series were continued. Results indicated that the thermal expansion of BeO is anisotropic, that the lattice expansion reaches saturation at about 5×10^{20} n/cm^2 for 1000°C irradiations, and that the BeO rods irradiated at elevated temperatures have greater strength. (M.C.G.)

24239 (HW-SA-2547) ENVIRONMENTAL TESTING OF REACTOR STRUCTURAL MATERIALS. A. L. Bement and J. J. Laidler (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 16, 1962. Contract [AT(45-1)-1350]. 17p.

A program is in progress to determine the mechanical property changes produced in Zircaloy-2 and several stainless steels by neutron irradiation in contact with pressurized, 300°C water. Irradiations are being carried out in a hot-water loop installed in the core of the Engineering Test Reactor. Tests to date indicated that the beneficial effects of cold work in respect to reducing the anisotropic behavior of Zircaloy-2. (M.C.G.)

24240 (NARF-61-40T) ANALYSIS OF RADIATION HEATING EXPERIMENT. G. E. Miller (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Dec. 29, 1961. Contract AF33(600)-38946. 32p. (FZK-9-169; AD-270807)

Two high-speed digital-computer codes were developed for calculating heat generation rates. These codes are based on the differential-energy-spectra data obtained by a moments-method solution of the Boltzmann transport equation and yield the modified spectrum at the point of interest from a given source point after penetration of a multilayer shield. A summation of the spectra from the individual source points gives the total spectra. Application of energy-absorption coefficients and an integration of the spectrum over energy yields the heat generation rate. To provide a verification of the results obtained from the codes, lead, iron, polyethylene, and lithiated polyethylene were exposed to radiation from the Ground Test Reactor. The calculated results agree within 40% of the measured heating rates. (auth)

24241 (NP-11852) RADIATION EFFECTS ON ELECTRONIC COMPONENTS: AN ANNOTATED BIBLIOGRAPHY. William L. Hollister, comp. (Lockheed Aircraft Corp. Missiles and Space Research Lab., Palo Alto, Calif.). Apr. 1962. Contract AF 04(647)-840. 94p. (SB-62-13)

An annotated bibliography containing 201 references on the effects of mixed reactor radiation on transient and damage effects in electronic equipment is presented. The information includes material up to February 1962. A subject index is included. (N.W.R.)

24242 (NP-11856) MONTHLY ACCESSION LIST NO. 59 [ON RADIATION EFFECTS DATA]. (Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio). July 15, 1962. Contract AF663(616)-7375. 19p.

The monthly accession list, June 1 to 30, 1962, on radiation effects on electronics, polymers, organic and inorganic compounds, metals and ceramics, dosimetry, facilities, space, and miscellaneous material is presented. An abstract is presented for each reference. (N.W.R.)

24243 (ORNL-3310) THE EXPERIMENTAL DESIGN FOR BeO IRRADIATION EXPERIMENTS ORNL 41-8 AND

ORNL 41-9. Donald A. Gardiner (Oak Ridge National Lab., Tenn.). July 18, 1962. Contract W-7405-eng-26. 25p.

The experimental plan for irradiating BeO pellets in experiments ORNL 41-8 and ORNL 41-9 was chosen in accordance with the principles of experimental design. The design is known by statisticians as a 2^5 factorial experiment "confound" in six replications. Five variables—time, density, grain size, temperature and time—are controlled at two levels to form the basic 2^5 factorial experiment. The sixth variable, neutron flux, is introduced by confounding on higher-order interactions. An explanation is presented in nontechnical language the means by which the aims of the experimenters and the physical conditions affecting the experiment were utilized in constructing the experimental design. (auth)

24244 (TID-15981) CONDUCTIVITY INDUCED IN SOLID INSULATING MATERIALS DURING GAMMA IRRADIATION. Gerald C. Huth (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). [nd]. Contract AT(11-1)-171. 21p.

A brief survey of work concerning increase of electric conductivity in solid insulating materials is presented. An experiment is discussed which was performed to measure radiation-induced currents in ceramic insulating materials at elevated temperatures and at somewhat greater radiation-rates than those previously used. Data are included for alumina, quartz, and statite ($MgO \cdot SiO_2$). (J.R.D.)

24245 (AEC-tr-5147) CONSEQUENCES OF NUCLEAR TRANSFORMATIONS IN GERMANIUM MONOCRYSTALS IRRADIATED WITH SLOW NEUTRONS. N. P. Kekelidze. Translated from p.557-63 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations, held in Prague, October 24-27, 1960. Vol. I." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/34(Vol.I(p.557-63))). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 6504.

24246 A METHOD FOR INCREASING THE UTILIZATION FACTOR OF γ-RAY IRRADIATION FACILITIES. V. G. Khrushchev, U. Ya. Margulis, and S. M. Stepanov. Atomnaya Energ., 12: 536-7(June 1962). (In Russian)

It is highly desirable for economic reasons to increase the utilization factor of industrial radiation sources to the highest possible extent. In most cases, a source in the shape of a rod or assembly of rods provides the most effective utilization of the space. The objects to be irradiated are placed on a conveyor belt along the source; the length of the straight-line portion is so chosen that at the bend of the belt the dose level is reduced by only a few percent from the value measured at the center of the straight-line portion. The number of the bends depends on the size of the objects to be irradiated ensuring an absorption of 95 to 98%. For obtaining a uniform irradiation, the height of the objects should be kept within 70 to 80% of the height of the active rods. It was found that better utilization is obtained if the specimens are placed in 2 levels, exchanging their position after the first cycle is completed. (TTT)

24247 THE DEVELOPMENT OF RADIATION-RESISTANT LUBRICANTS. R. Irving and Scarlett. Atoomenergie, 4e: 73-80(Apr. 1962). (In Dutch)

The results of investigations leading to the selection of materials that give satisfactory operation in the presence of reactor radiation are summarized. The laboratory experiments on the factors which affect the radiation stability of a lubricant are first described. The performance of the most promising materials under dynamic operating conditions in the laboratory and bearing-rig tests in a reactor are then reviewed. The results show that in the presence of nuclear radiation, hydrocarbon oils cross-link, and an increase in viscosity occurs together with gas evolution. For maximum resistance to radiation, oils of relatively high aromatic content and low molecular weight should be used. Conventional metallic soap-based greases are relatively unstable and lose their structure, becoming liquid. Greases based on a special form of silica are much more resistant. The results of extensive dynamic rig testing of such greases confirm their suitability as lubricants for operation in a radiation environment at relatively high temperatures (up to 150°C) in an atmosphere of carbon dioxide. (J.S.R.)

24248 THE EFFECTS OF IRRADIATION ON THE DIELECTRIC AND OTHER PROPERTIES OF POLYETHYLENE. Y. Inagaki and U. Shinohara. Denki Gakkai Zasshi, 7: 904-11(July 1960).

Polyethylene samples prepared by high pressure and low pressure methods were γ-irradiated by a Co^{60} source. Increasing dosage produced an increasing weight change. The weight increment was indirectly proportional to the thickness of the specimen for a constant dosage. With increasing dosage, the tangential increment of the dielectric loss angle increased significantly, while the increment of the dielectric constant decreased. Infrared analysis showed that γ irradiation promoted oxidation, and surface oxidation was prevalent. The variation of the dielectric characteristics by γ irradiation was less with the low pressure method polyethylene than with the high pressure method polyethylene. (OID)

24249 THE MODIFICATION OF FIBERS BY NUCLEAR RADIATION. PART I. Wolfgang Bobeth, Adolf Heter, and Annelies Weihs. Faserforsch. u. Textiltech., 12: 381-9 (Aug. 1961).

The nature of α, β, γ radiation and the influence on organic polymers from the viewpoint of textile technology are discussed. Phenomena, such as splitting of the chemical bond, radical formation "case effect," recombination, and interlacing are described. A summary is given of the properties of those radioisotopes which are used predominantly in the textile industry, namely, C^{14}, Na^{22}, Na^{24}, etc. Because of the great importance of γ radiation for modifying fibers, and the use of Co^{60} as the main source of this radiation, the reaction of the most significant polymeric group to this radiation is shown in their structural formulas. The great influence of the environment (air, oxygen, nitrogen) on the course of the reaction is emphasized. The chemical and physical changes, which the most common textile fibers undergo under the impact of γ radiation and neutron bombardment, are discussed, and graphs are given which show the relationship between radiation energy and physical parameters of cellulose (cotton), protein fibers (silk and wool), polyacrylates, polyesters, polyamides (nylon), and acetate fibers. In general, most fibers undergo deterioration in quality, while a minority show improvement of certain properties. (OID)

24250 THE MODIFICATION OF FIBERS BY NUCLEAR RADIATION. PART II. Wolfgang Bobeth, Adolf Heger, and Annelies Weihs. Faserforsch. u. Textiltech., 12: 423-9 (Sept. 1961).

Results are presented of investigations of various textile fibers (polyester, polyamide silk, regenerated cellulose, polyacryl fibers, flax, cotton, and wool) which were exposed to neutron bombardment in the reactor at Rossendorf (East Germany). The strength and elongation of multifilament yarns are reported, and the upper limits of dosage for important textiles are given. (OID)

24251 RADIATION DAMAGE IN SOLIDS AND REACTOR MATERIALS. Intern. At. Energy Agency Bull., 4: No. 3, 15-18(July 1962).

A summary is given of the papers and discussions presented at the Symposium on Radiation Damage in Solids and Reactor Materials in Venice, Italy, on May 7 to 11, 1962. The materials studied included fissionable materials, moderator materials, and semiconductors. (D.L.C.)

24252 LOW DOSE GAMMA IRRADIATION OF ALLOY JUNCTION TRANSISTORS. D. E. Vaughan (Royal Military Coll. of Science, Shrivenham, Eng.). J. Electronics and Control (1), 12: 307-12(Apr. 1962). (In English)

Investigations are carried out of the effects of small (10 kilorad) doses of Co^{60} gamma radiation on germanium p-n-p alloy junction transistors, with particular reference to the effect upon gain and minority carrier lifetime. The results support hypotheses dealing with the effect of radiation on germanium alloy junction diode parameters. (auth)

24253 DYNAMIC MECHANICAL STUDIES OF IRRADIATED POLYPROPYLENE. J. A. Sauer, L. J. Merrill, and A. E. Woodward (Pennsylvania State Univ., University Park). J. Polymer Sci., 58: 19-28(Apr. 1962).

The internal friction and the dynamic modulus of isotactic polypropylene samples subject to varying degrees of pile irradiation were studied at low audio frequencies and over the temperature range from 100 to over 400°K. The radiation dosages used varied from 5.4×10^{17} to 14×10^{18} nvt. For irradiation doses up to about 3×10^{18} nvt, one observed change is a decrease in the temperature at which the final upswing in damping and drop in modulus occurs, presumably as a result of defects produced in the crystallites by the irradiation. As the irradiation dose increases above 3×10^{18} nvt, all evidence of crystallinity is lost, and the internal friction peak which occurs in the neighborhood of 300°K and which is associated with the glass transition of the amorphous regions moves to higher temperatures as a result of the increasing chain-stiffening effect due to crosslinking. The secondary loss peak at 250°K attributed to the motion of a small number of segments in the amorphous regions is found to increase in magnitude with increasing dose. The results of density determinations made before and after irradiation and also after subsequent exposure of the irradiated samples to melting temperatures and of solvent extraction studies of the irradiated samples confirm the simultaneous occurrence of crosslinking and of crystalline degradation upon pile irradiation of polypropylene samples. (auth)

24254 USE OF DIMALEIMIDES AS ACCELERATORS FOR THE RADIATION-INDUCED VULCANIZATION OF HYDROCARBON POLYMERS. S. H. Miller, R. Roberts, and R. L. Vale (Atomic Energy Research Establishment, Wantage, Berks, Eng.). J. Polymer Sci., 58: 737-54(Apr. 1962).

The effect of alkyl and aryl dimaleimides on the rate of crosslinking of natural rubber is described by means of experiments with ionizing radiation. The dose for vulcanization can be reduced from 5×10^7 to 2.0×10^6 rad by use of purified rubber and 5% of additive, and the reaction is dose-rate dependent with an intensity exponent of 0.57. The reaction is further accelerated by the addition of small quantities of solvents. By use of C^{14}-labeled dimaleimides, it is shown that there is approximately one dimaleimide unit to each crosslink. Possible chain mechanisms for the reaction are discussed. (auth)

24255 AN INVESTIGATION OF THE POSSIBILITY OF INCREASING THERMAL STABILITY OF POLYOLEFIN FIBERS BY MEANS OF IONIZING RADIATION. S. A. Nechaeva, Yu. M. Malinskiĭ, and Z. A. Rogovin. Khim. Volokna, No. 3, 7-9(1960).

It is known that the polyolefin fibers used in industry have low thermal stability. These fibers and their products have the following disadvantages: irreversible shrinking at increased temperatures, and considerable decrease in strength with increase in temperature. Studies were made of the possibility of increasing the thermal stability of polyolefin fibers by radioactive radiation and of the behavior of polypropylene and polyethylene fibers. The shaped and drawn fiber was irradiated with Co^{60} γ rays in a vacuum at a dosage of 0.7 to 0.8 Mrad/hr. The increase in thermal stability of the fiber after irradiation was determined mainly by the change in shrinking at different temperatures between 50 and 100°. The change in strength and elongation at increased temperatures of nonirradiated fibers and of polyethylene fibers irradiated with different doses of γ rays was investigated also. Results showed that the shrinking of polypropylene fibers at increased temperatures was reduced considerably by irradiation, but there was also a considerable deterioration of the mechanical properties. In the polyethylene fiber, irradiation reduced the flowing of the fiber at increased temperatures but did not reduce the losses in strength at such temperatures. (OID)

24256 A STATISTICAL THEORY OF LATTICE DAMAGE IN SOLIDS IRRADIATED BY HIGH-ENERGY PARTICLES. Lénárd Pál and Géza Németh. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 246-61(July-Aug. 1958). (In Hungarian)

The distribution function for the number of lattice displacements in solids irradiated by high-energy particles is determined by exact methods available in the theory of probability. The generating function of the distribution function yields equations determining the average number of displacements and their dispersion. These equations are solved upon the assumption that the primary bombarding particles are neutrons and that collision phenomena between displaced atoms and atoms vibrating in the lattice may be regarded as a collision between balls of perfect rigidity. It is found that the variance of the number of lattice displacements is larger than the variance of Poisson's distribution for the case of irradiation by fission neutrons. The relative standard distribution is found for the case in which the thickness of the irradiated sample is small compared with the mean free path of the neutrons. (auth)

24257 THE EFFECT OF IONIZING RADIATION ON THE TENSILE STRENGTH AND ELONGATION OF WOOLS. G. Satlow. Melliand Textilber., 41: 1525-7(Dec. 1960).

Different types of wool were subjected to Co^{60} γ irradiation. It was found that the wet tensile strength and the wet elongation decreases with increasing dose (0.2 to 5.0×10^{17} n/cm^2) in single wool fibers. The loss in wet tensile strength increases stepwise between 0.8 and 1.0×10^{17} n/cm^2; after a dose of 5.0×10^{17} n/cm^2, wool no longer possesses any strength. The tensile stress-strain curves are in lower regions after increased doses of neutron irradiation, but they are, in principle, parallel to those of untreated wool. Neutron irradiation produces the same effect on strength and elongation as extended exposure to weather: the cysteine acid content and alkali solubility increase, while the strength and elongation decrease. The effect of γ irradiation on wool (8×10^8 rad) causes only a slight decrease in wet tensile strength and wet elongation in sheep wool, while camel wool shows a much stronger decrease. (OID)

24258 POINT DEFECTS IN NIOBIUM, MOLYBDENUM AND TANTALUM. D. E. Peacock and A. A. Johnson (Imperial Coll., London). Nature, 195: 169(July 14, 1962).

A preliminary account is given of the measurement of changes in electrical resistivity in neutron irradiated Nb and Mo and plastically deformed Nb and Ta. Recrystallized Nb and Mo wires were irradiated for periods of 3, 6, 9, and 12 months at 40°C. Isochronal and isothermal recovery curves obtained revealed one recovery peak for each metal. That for Nb occurred at 120°C and had an associated activation energy of 1.22 ± 0.02 ev, while that for Mo was at 160°C with an associated activation energy of 1.35 ± 0.08 ev. For both metals the magnitude of the recovery, $\Delta\rho$, passed through a maximum with increasing neutron dose. Recovery curves obtained for deformed Nb and Ta gave results similar to those found for the irradiated material. For Ta, a recovery peak was found at 120°C with an associated activation of 1.25 ± 0.02 ev. (P.C.H.)

24259 THE EFFECTS OF γ-IRRADIATION AND ROLLING ON THE TEARING PROPERTIES OF POLYETHYLENE. Yoshinori Tsunekawa, Jôbu Awatani, and Kihei Kojima. Nippon Kikai Gakkai Rombunshû, 27: 163-6 (Jan. 1961).

Polyethylene samples of 2 mm thickness were γ-irradiated in water. The total dosage for the samples irradiated after the rolling treatment was 1.5×10^5 r/hr, while the dosage for the samples irradiated before the rolling was 1.2×10^5 r/hr. The tensile strength of the irradiated and rolled sample increased with increasing dosage. A comparison of tearing strengths between the rolled samples and the rolled and irradiated samples was made. (OID)

24260 ENERGY DEPENDENCE OF ELECTRON DAMAGE IN COPPER. A. Sosin (Atomics International, Canoga Park, Calif.). Phys. Rev., 126: 1698-1710(June 1, 1962).

Electron irradiation below 1-Mev and subsequent recovery in copper were investigated. The minimum threshold displacement energy is less than 22 ev. The details of the recovery in stage I, as a function of electron energy, are more complex than anticipated. Specifically, I_a decreases, I_b increases slowly, and I_c increases rapidly, respectively, in relative importance as the electron energy is reduced. A calculation of the cross section for displacement of copper atoms by electrons is also presented. A Born-Mayer potential with standard parameters is used. Only displacements in or near the close-packed directions are evaluated in detail. Other directions do not appear to contribute significantly in the near threshold energy region being considered. The agreement between this theory and experiment is found when a minimum threshold displacement energy at 19 to 20 ev and a Frenkel resistivity at 2 to 3 μohm-cm/at. % of interstitial-vacancy pairs are assumed. (auth)

24261 MEASUREMENT OF THE E MODULUS AFTER COLD DEFORMATION IN IRRADIATED AND NON-IRRADIATED COPPER. A. Zetzsche and O. Hauser (Zentralinstitut für Kernphysik, Dresden). Phys. status solidi, 2: XXI-5(1962). (In German)

The modification of the modulus of electrolytic Cu after cold working was investigated as a function of time. The time measurement of the modulus depends on the migration of point faults produced in the working. The results show that there is a straight line relation between $t^{1/2}$ and $\lg \Delta E/E$, in good agreement with theory. The variation of the E modulus with respect to the degree of deformation in irradiated and non-irradiated samples was determined. The modulus change increases with increasing deformation, which can be traced to an increase of the transfer density with increasing deformation. At extended deformation the transfer density is compensated. (J.3.R.)

24262 THE ALTERATION OF MECHANICAL PROPERTIES OF CORD UNDER THE INFLUENCE OF IONIZING RADIATION. M. Krejcik. Plaste u. Kautschuk, 8: 66-9 (Feb. 1961).

The increasing use of ionizing radiation in the region from 1 to 5×10^7 rep for the vulcanization of rubber tires has shown that in the manufacture of these tires the mechanical properties of cord are affected by irradiation within this region. In order to select the most resistant core types, samples from different cord materials were irradiated with Co^{60} γ rays in the region from 10^4 to 10^5 rep. For this purpose, a special irradiation assembly was constructed using as the radiation source, 200 c of Co^{60}. Cord types, "Terylen-," "Dederon-," "Kapron-," "Silon-," "Nylon-" "Rudnik-" "Cordenka-," and Egyptian cotton cord, were examined and after irradiation these samples were tested for stability, strength, elasticity, and extensibility. It was found that ionizing radiation in the presence of air reduced the strength and elasticity of all core types examined. The least resistance was shown by the polyamid cords (Silon, Kapron, and Nylon), while the highest was shown by Terylen (a polyester of terephthalic acid). (OID)

24263 THE INFLUENCE OF γ-RADIATION AND NEUTRONS ON LACQUER COATINGS. Zbigniew Jedliński, Zdzisław Hippe, and Tadeusz Umiński. Przemysł Chem., 39: 110-12(Feb. 1960).

An investigation was made of the influence of γ radiation and of neutrons on protective coatings of various film-forming materials, such as chlorinated rubber, chlorinated polyvinyl chloride, polyvinyl butyral, copolymer of vinyl chloride and isobutyl ether or polyvinyl alcohol, alkyd resin, phenol-formaldehyde resin and polymerized linseed oil. The radiation time was 3 mo (2,160 hr) at 10,800 r. Thoroughly cleaned test plates were coated twice at 24-hr intervals. Twelve plates were coated with each lacquer; 4 of them were irradiated, 4 were aged under normal atmospheric conditions, and 4 were examined at the beginning of the experiment for physicochemical properties. Samples for irradiation were fastened to a regular 16-wall drum 26 cm in dia., equidistant from the radiation source. In the center of the drum a Pt needle with 100 mg of Ra^{226} screened by Be was placed. Results showed that coatings made of polyvinyl butyral, copolymer of vinyl chloride and isobutyl ether of polyvinyl alcohol, alkyd resin or polymerized linseed oil had much better elasticity and shock resistance than samples aged under normal atmospheric conditions. Irradiated samples of coatings made of chlorinated rubber, chlorinated polyvinyl chloride and phenol-formaldehyde resins lost their elasticity and adhesion. (OID)

24264 STUDIES ON 6-NYLON FIBERS IRRADIATED BY γ-RAYS. I. THE PRACTICAL PROPERTIES AND VISCOSITY-AVERAGE MOLECULAR WEIGHT OF UNDRAWN FIBERS IRRADIATED IN VARIOUS ATMOSPHERES. Minoru Hashimoto and Hisao Ameniya. Repts. Govt. Chem. Ind. Research Inst., Tokyo, 17: 446-50(May 1961).

The viscosity-average molecular weight decreases rapidly with irradiation up to 10 Mr but more slowly above 10 Mr. The solubility in an 80% aqueous solution of formic acid changes slightly with irradiation up to 10 Mr but increases rapidly from 10 to 110 Mr. In the lower range of irradiation doses, the melting point, mechanical proper-

ties, and solvent resistance increase slightly by the formation of crosslinkages. The changes in properties by irradiation in 10^{-2} mm Hg air and 760 mm Hg N_2 gas after removing air to 10^{-2} mm Hg are nearly the same, but those in 760 mm Hg air are greater than in 10^{-2} mm Hg air. The formation of crosslinkages and main-chain scissions increases with irradiation in the oxygen atmosphere. (OID)

24265 THE IMPROVEMENT OF THE DYEING PROPERTIES OF POLYETHYLENE FIBERS BY GRAFT POLYMERIZATION OF METHACRYLIC ACID USING γ-IRRADIATION. Gensaku Aida, Masaru Mitsuishi, and Tamotsu Ishida. Shinshu Daigaku Sen Igakubu Kenkyū Hōkoku, No. 10, 270-3(Oct. 1960).

γ-Ray induced Hi-Zex polyethylene fiber was graft-polymerized with methacrylic acid. The dyeing properties of the polyethylene fiber was improved by the grafting reaction. The basic dyes used in the experiment were Astrazone Red BBL and Rhodamine 6 GCP. Tabular data are given for (1) absorption of the dyes by the multi-filament of grafted polyethylene fibers, and (2) the melting point of the grafted polyethylene fibers. The increases in weight after grafting of mono- and multi-filaments are graphed. (OID)

24266 ELECTRICAL CONDUCTIVITY OF MAGNESIUM AND ZINC TITANATES SUBJECTED TO NEUTRON RADIATION. L. K. Vodop'yanov (Lebedev Inst. of Physics, Moscow). Soviet Phys.-Solid State, 4: 52-4(July 1962).

The effect of irradiation by slow neutrons on the temperature dependence of the electrical conductivity of magnesium and zinc titanates was investigated. It was found that the activation energy changed as a result of irradiation. (auth)

24267 RADIATION-INDUCED CHANGES IN THE PROPERTIES OF ROCHELLE SALT CRYSTALS (IN WEAK ELECTRIC FIELDS.) E. V. Peshikov and S. V. Starodubtsev (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Soviet Phys.-Solid State, 4: 170-4(July 1962).

The effect of gamma radiation on the dielectric and electromechanical properties of Rochelle salt crystals as measured in weak electric fields was investigated. The results obtained were in qualitative agreement with the notion of diminishing domain effects as a contribution to the indicated parameters. (auth)

24268 AN INVESTIGATION OF DIFFUSION PROCESSES IN SEVERAL POLYMERS. III. IRREVERSIBLE CHANGES IN DIFFUSION CHARACTERISTICS RESULTING FROM Co^{60} γ-IRRADIATION OF THE POLYMER. N. S. Tikhomirova, Yu. M. Malinskii, and V. L. Karpov. Vysokomolekulyarnye Soedineniya, 2: 1335-45(Sept. 1960).

The action of γ radiation on the diffusion of He and Ar through irradiated polymers (polyethylene, polyamide 54/10, methanolpolyamide 2/10, polytetrafluoroethylene, polyvinyl chloride, and SKS 30) was investigated. Results showed that an increase in the absorbed energy (dose) produced (a) a decrease in the diffusion rate of gases through polyethylene, polyamides, and SKS-30 which is connected with the formation of crosslinkages between the molecules; (b) a sharp increase in the rate of the diffusion of the gases in polytetrafluoroethylene and polyvinyl chloride; (c) a decrease in the dissolution of the gases in polyethylene and an increase in polyvinyl chloride and polytetrafluoroethylene; (d) an increase in the activation energy of diffusion, enthalpy, and entropy of gas dissolution for polyamides and a decrease for polyethylene; and (e) an increase in the magnitude of the activation energy of permeability which depended on a decrease in the enthalpy of dissolution with the dose. (OID)

24269 EFFECTS OF NEUTRON IRRADIATION IN NON-FISSIONABLE METALS AND ALLOYS. Bibliographical Series No. 6. (International Atomic Energy Agency, Vienna). 1962. 174p. (STI/PUB/21/6). $1.50(IAEA).

The bibliography contains 735 references to literature published in various languages from 1956 to 1962. Abstracts are given in English or Russian, mostly corresponding to the original language of the paper or in some few cases to the language of the abstracting journal used. An author index is included. Information is presented on the effects of radiation on the principal properties of non-fissionable metals and alloys, radiation damage experiments, radiation damage measurement techniques, and general aspects of the problems. (N.W.R.)

PHYSICS

General and Miscellaneous

Refer also to abstracts 23973 and 23974.

24270 (AERE-R-4029) THE ZEEMAN EFFECT OF THE ARC AND SPARK SPECTRA OF YTTERBIUM AND THULIUM. L. Allen (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). May 1962. 34p.

A description is given of the techniques used to measure 358 Zeeman patterns in ytterbium I and II and 368 Zeeman patterns in thulium I and II. Wavelengths of the lines together with the position of the π and σ components and a description of the type of pattern are listed in tables. Good agreement occurs between the g values in ytterbium and those published by Racah. The g-values for 38 thulium levels are also given. (auth)

24271 (AERE-R-4043) NEUTRON SCATTERING STUDIES OF LIQUID DIFFUSION. P. A. Egelstaff (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). May 1962. 36p.

Theories of diffusion in liquids have assumed the motion to be either gas-like or solid-like. The underlying idea is that atoms move singly: free translational motion in gases, vibrational motion with jumping from site to site in solids. It is shown that the classical data on liquids (diffusion and viscosity coefficients, etc.) lead to the conclusion that liquid diffusion is quite unlike the solid or gas cases, in that it involves the cooperative action of a number of atoms (~100) over a range of ~5 atomic distances. The cooperative unit, a globule, is allowed both translational and rotational motion. This spinning globule liquid model leads to definite predictions of the neutron scattering by liquids. These predictions agree with the data. It is therefore concluded that, in liquid metals at least, there is direct evidence for the existence of co-operative units (or spinning globules), and that these units determine the diffusive properties of the liquid. In addition near the freezing point jump diffusion can be important, so that two-component model of the diffusion process is needed there. (auth)

24272 (APED-3959) DIFFUSION OF ELECTRONS AND IONS IN A NEUTRAL GAS. Edwin Blue, John H. Ingold, and W. J. Ozeroff (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). May 1962. 19p.

The diffusion theory of electrons and ions flowing in a scattering gas under the influence of their own and externally applied electric fields is formulated. It is assumed that the charged particles originate on and are absorbed by the boundaries and that there are no volume sources. The theory is applied to the high pressure cesium thermionic converter. Numerical solutions for the particle and potential distributions in typical cases are presented. (auth)

24273 (BRL-1152) SHOCK WAVES FROM EXPLODING WIRES AT LOW AMBIENT DENSITIES. F. D. Bennett and D. D. Shear (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Oct. 1961. 34p. (AD-271165)

The technique of streak interferometry was applied to study 4 mil Cu wires exploded into argon at reduced pressures. Typical interferograms at $1/16$ atm show an intensely luminous, peripheral arc formed in an annulus several mm from the wire. When filters are used to diminish the diffuse light from the glow, clear fringes can be reduced in the entire glowing region. Near the tip, measured fringe-shifts are negative indicating the presence of electrons. No shock wave is seen. During an interval of about 1 microsec fringe-shifts near the periphery of the expanding glow change to positive values and a compressional shock wave can be seen to separate and propagate ahead. Estimates obtained from approximate interferogram reductions indicate electron densities as high as 10 to the 18th power/cc in the annular region of the arc. A sequence of interferograms at pressures $1/16$ to 1 atm is presented and implications for the mechanism of shock production are discussed. (auth)

24274 (CEA-BIB-26) ETUDES FAITES SUR LES BULLES. (Bubble Studies). Philippe Monod (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1962. 67p.

The literature surveyed deals mainly with studies of the factors of nucleation and the laws of growth of bubbles in a homogeneous, superheated liquid. With this in sight some more general attempts are reported dealing especially with surface tension and drops. The main results are given as figures and formulas. This survey was carried out principally to indicate methods of bubble chamber operation. A subject and author index is provided for the 86 annotated references. (auth)

24275 (CLM-R-18) THE DESIGN, CONSTRUCTION, INSTRUMENTATION AND PERFORMANCE OF AN 8 × 2 INCH SHOCK TUBE. R. Hide, N. H. Price, and P. A. Shatford (United Kingdom Atomic Energy Authority. Research Group. Culham Lab., Culham, Abingdon, Berks, England). May 1962. 27p.

The theory of gas flow in a shock tube is outlined and augmented by tables of useful numerical data on shocks. Details are given of the special design considerations necessary in the construction of a large shock tube. Instrumentation is discussed in three parts dealing respectively, with the filling of the tube with gases A and B to the desired pressures, the detection of the shock and the timing of its speed by electronic techniques, and an optical system used for making Toepler-Schlieren and shadowgraph observations of the gas flow associated with the shock. Finally a series of calibration experiments is described. (auth)

24276 (GA-2824) ION-NEUTRAL COLLISIONS IN AFTERGLOW. W. L. Fite, J. A. Rutherford, W. R. Snow, and V. A. J. van Lint (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Jan. 23, 1962. Contract DA-49-146-XZ-049. 19p.

In order to study collisions between ions and neutral particles at thermal energies, a series of experiments were carried out which utilize high-speed mass-spectrometric monitoring of the afterglows in gases produced by radio-frequency discharges and 20-Mev electron pulses. Ion-clustering, charge-transfer, and ion-exchange processes were observed in atmospheric gas mixtures. From the ion histories in the afterglows, approximate values of the pertinent reaction rates are deduced. (auth)

24277 (IS-349) ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS, JULY 1, 1960 to JUNE 30, 1961. (Ames Lab., Ames, Iowa). Sept. 1961. Contract W-7405-eng-82. 68p.

Progress is reported on research in nuclear and solid-state physics. (M.C.G.)

24278 (JINR-P-971) K VOPROSU OB ANOMALII PRI RASPADE μ^- MEZONOV V MEZOATOMAKH PEREKHODNYKH METALLOV GRUPPY ZHELEZA. (On the Anomalies in μ^- Meson Decay in Mesoatoms of Transitional Iron Group Metals). L. B. Egorov, A. E. Ignatenko, A. V. Kuptsov, and M. G. Petrashku (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 10p.

Relative measurements of the probabilities of the μ^- meson decay in Fe, Zn, Ni, and Cu mesic atoms were made using scintillation counters. The gamma ray yields from the targets were found the same within experimental error. This indicates that the apparatus effect is not the reason for anomalies. (auth)

24279 (NAA-SR-Memo-6782) COMPARISON OF PRESSURE DROP PRODUCED BY SPIRAL WRAPS, COOKIE CUTTERS AND OTHER ROD BUNDLE SPACERS. R. C. Noyes (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 17, 1961. Contract AT(11-1)-Gen-8. 27p.

The problem of predicting pressure drop due to various fuel bundle spacers is considered in some detail. Three sets of experimental data are reviewed and presented in reduced form. These data are compared to several semi-theoretical approaches to pressure drop prediction and a best method is selected to make the required predictions. The comparison between predictions for the ASCR spiral wrap spacer and cookie cutter spacer shows that both types of spacers produce about the same pressure drop. Spacer pressure drop is shown to be strongly dependent on spacer frontal area and pitch. (auth)

24280 (NASA-TN-D-1307) ESTIMATION OF CRITICAL TEMPERATURE FOR SURFACE ION CURRENTS FROM ELECTRON EMISSION DATA. Thaine W. Reynolds (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). May 1962. 15p.

Critical surface temperature–Cs ion current density relations are presented for the surfaces Re, Mo, Ta, and Nb. A method is described by which these relations were obtained from the electron emission data from these surfaces in the presence of Cs vapor. (auth)

24281 (NP-11846) RATIO OF THE DIFFUSION COEFFICIENT TO THE MOBILITY COEFFICIENT FOR ELECTRON IN He, A, N_2, H_2, D_2, CO, AND CO_2 AT LOW TEMPERATURES AND LOW E/P (WITH TABULATED DATA). Scientific Paper 62-908-113-P6. Technical Report No. 12. Roger W. Warren and James H. Parker, Jr. (Westinghouse Electric Corp. Research Labs., Pittsburgh). June 4, 1962. Contract NONR 2584(00). 53p.

D/μ, the ratio of the diffusion coefficient to the mobility coefficient for electrons, was determined as a function of E/p, the ratio of the electric field to pressure, in He, Ar, N_2, H_2, D_2, CO, and CO_2. Special interest is centered on the low temperature, low E/p data which are essential for the determination of low energy elastic and inelastic cross sections. The lowest temperature of operation is either 77°K or the boiling point of the gas being measured, whichever is higher. The lowest E/p value is well within the thermal range where $D/\mu = kT/e$. A careful analysis of the operation of the experimental tube is presented along with a method for removing inconsistencies in the results which arise from a conventional interpretation of the data. (auth)

24282 (NP-11906) AN EXPERIMENTAL METHOD FOR MEASURING THE ELECTRICAL CONDUCTIVITY OF HIGH TEMPERATURE GASES. Technical Report WT-35. Gordon F. Anderson (Brown Univ., Providence). June 1962. 57p.

The feasibility of utilizing the effect of a conducting medium on the impedance of a small coil for the measurement of the conductivity of high temperature gases was first investigated theoretically and then developed experimentally. The method described is particularly well suited for measuring the electrical conductivity of gases at high densities. Data which were obtained for air in the range of 5 mhos/meter to 250 mhos/meter at atmospheric density are included in order to illustrate the use and feasibility of the experimental technique. (auth)

24283 (NYO-7885) DOPPLER BROADENING OF THE He^+ 4686 LINE IN ION TEMPERATURE MEASUREMENTS. Technical Memo No. 42. K. E. Weimer (Princeton Univ., N. J. Project Matterhorn). Jan. 1957. Contract AT(30-1)-1238. 26p.

The measurement of the broadening of the He II complex line λ 4686 A was widely used to estimate ion temperatures in plasmas. Such broadening was assumed as a first approximation to arise only from the Doppler effect. An analysis is presented concerning the broadening as a function of both temperature and magnetic field. All other sources of broadening were assumed to be negligible. (auth)

24284 (TID-15973) MAGNETIC PROPERTIES OF He^3 AT LOW TEMPERATURES. Technical Report No. 2. William Reese (Illinois. Univ., Urbana). Apr. 1962. Contract AT(11-1)-1956. 122p.

The coefficient of self-diffusion of magnetization and the magnetic susceptibility of pure liquid He^3 were measured using the method of spin echoes at pressures to 28.2 atm and temperatures down to 0.025°K. In all cases the self-diffusion coefficient increased with decreasing temperature below 0.3°K. The temperature dependence becomes T^{-2} at the lowest temperatures in agreement with the Landau model of a Fermi liquid. Qualitative agreement between the theoretically predicted and measured diffusion coefficients was observed over the entire range of pressures. The susceptibility was found to become independent of temperature at sufficiently low temperatures, except possibly at the highest pressures, in agreement with the Landau model. The susceptibility divided by the density was found to increase monotonically with pressure. (auth)

24285 (TID-16127) THE SPECTRUM, THE EXCITATION AND IONIZATION CROSS-SECTIONS FOR PHOTO PROCESSES AND FOR COLLISIONS, OF FIVE TIMES IONIZED OXYGEN. Fourth Quarterly Report, March 1, 1962–May 31, 1962. Carlos M. Varsavsky (P.E.C. Corp., Boulder, Colo.). Contract AT(11-1)-1017. 21p.

Work is reported on calculation of inelastic collision cross-sections between electrons and ions. Numerical data are used as a basis for conclusions with regard to intrinsic accuracy to be expected of a computed transition integral. It is noted that the greatest amount of information can be derived from application of the sensitivity criterion to the screening approximation. The validity of these conclusions can be checked for general validity by applying the criterion to the Coulomb approximation and to transition integrals computed by means of Hartree-Fock wave functions. Calculated transition data are included along with spectral data for O(VI). (J.R.D.)

24286 (UCRL-6797) SHOCK HYDRODYNAMICS. Mark L. Wilkins (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 19, 1962. Contract W-7405-Eng-48. 23p.

The Hugoniot relations, which express conservation of mass, momentum, and energy across a discontinuity, are

derived. The relations are applied to a perfect gas for illustration, and graphical methods of solving shock problems are presented. (auth)

24287 (UCRL-6891) GAMMA ENERGY DEPOSITION IN INFINITE SOURCE MEDIA (thesis). Alex Lorenz (California. Univ., Livermore. Lawrence Radiation Lab.). May 15, 1962. Contract W-7405-eng-48. 77p.

Based on the principle of energy conservation, a time-independent multigroup technique to calculate photon energy deposition in materials composing an infinite gamma-ray source medium was derived and coded for the IBM 7090 computer. Applicable to homogeneous media, the method is extended to treat nonhomogeneous media by applying self-shielding corrections to the cross sections. The results of sample calculations show good agreement with Monte Carlo results. The code utilizes microscopic cross-section input in calculating self-shielding factors, probabilities of gamma-ray interactions and energy down-scatter; these quantities determine the allocation of the photon energies of a given source spectrum to the constituent elements of the medium. With a capacity to handle 30 energy groups and 9 materials, a single problem runs a fraction of a minute on the IBM 7090 computer. (auth)

24288 (FTD-TT-62-317) COMPENSATION OF ION SPACE CHARGE BY ELECTRONS. V. P. Ignatenko and A. S. Myasnikov. Translated from Radiotekh. i Elektron., 6: 2084-92(1961). 16p.

The propagation of a one-dimensional ion stream whose space charge is compensated by electrons at a certain cross section of the stream is examined. The study was made under the following assumptions: the motion of the electron-ion stream was considered steady-state in the external stationary electrostatic fields; the presence of residual gases in the vacuum system and the recharging of ions due to it was negligible; the recombination processes of charged particles in the stream were not taken into account; in the case when wire gauze electrodes were used, the current losses in them were ignored, and the electrical field was considered fixed in the plane of the grids; and the initial velocities of all charged particles were assumed to be the same. (N.W.R.)

24289 (NP-tr-898) INVESTIGATION OF THE BRIGHTNESS OF THE CHANNEL OF A SPARK DISCHARGE IN ATMOSPHERES OF ARGON AND XENON. M. P. Vanyukov, A. A. Mak, and N. V. Parazinskaya. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Optika i Spektroskopiya, 1: 642-9(1956). 21p.

A photoelectric method was used to investigate the spectral density of the energy brightness in the middle of a spark discharge channel in argon and xenon as a function of wavelength at different moments of time from the beginning of the discharge, with variation of the inductance of the discharge circuit. Saturation of the maximum instantaneous brightness of the channel in xenon was found to occur with decrease in the inductance of the discharge circuit. The limit value of this brightness is 11×10^6 stilbs. The discharge in an atmosphere of argon shows an increase of brightness with decrease in inductance. A comparison is made of the radiation of a spark discharge with that of an absolutely black body. (auth)

24290 (UCRL-Trans-399(L)) ELECTRONIC ENERGY LEVELS AND RADIATION OF ATOMS IN CRYSTALS. [PARTS I THRU V]. K. H. Hellwege. Translated by M. W. Nathans (Univ. of California Lawrence Radiation Lab., Livermore) from Ann. Physik (6), 4: 95-163(1948). 119p.

The following characteristics were determined for 27 non-cubic symmetry classes: the electronic eigen functions in zero order approximation and the corresponding quantum numbers in the crystal; the number and the degeneracy of the components in which a level of given angular momentum of the free atom will split when the atom is inside a crystal; and the selection rules and polarization in the crystal for electric dipole radiation. The selection rules of the crystal quantum numbers for magnetic dipole radiation and electric quadrupole radiation were derived for the 27 non-cubic crystal classes. The Kramers degeneracy and quantum numbers of the electronic levels, electric potential in the crystal and Kramers degeneracy, and selection rules for electric and magnetic dipole and electric quadrupole radiation were also studied for the 5 cubic symmetry classes. (auth)

24291 SOLID SCINTILLATORS: SOME ASPECTS OF GOVERNING PRINCIPLES, RESEARCH, AND ACHIEVEMENTS. G. A. Giger. Acta Electronica, 5: 111-30(Jan. 1961).

Scintillators are defined, and the properties of the scintillators are discussed. A schematic summary of the mechanism of operation aids in understanding the composition and production as well as the use of scintillators. The most recent applications are mentioned, and other possible applications are discussed in which scintillation detectors could replace presently used equipment advantageously. (OID)

24292 THE SPECTRUM OF IONIZED BERYLLIUM, Be II. Lennart Johansson (Univ. of Lund, Sweden). Arkiv Fysik, 20: 489-98(1962). (In English)

The spectrum of singly ionized beryllium is studied by using a hollow-cathode discharge. Wavelengths are determined for 46 lines between 12,100 and 1500 Å, and the term system is revised and extended with the aid of the measurements. (auth)

24293 SPECTRA OF SCATTERED RADIATION BEHIND SLABS OF WATER IRRADIATED BY X-RAYS. Bengt Bjaerngard and Gunnar Hettinger (Univ. of Lund, Sweden). Arkiv Fysik, 20: 517-26(1962). (In English)

The radiation scattered in different directions behind irradiated water slabs was measured with a NaI scintillation spectrometer. The primary radiation was obtained from an x ray generator supplied with thick filters. By using the memory of a multichannel analyzer, the spectra in different directions were also integrated over all angles in order to give the spherical flux. The integrated radiation behind the slabs was compared with that present at equal depth in a semi-infinite water phantom. (auth)

24294 RELATIVISTIC DIFFERENTIAL AND TOTAL K-SHELL PHOTOELECTRIC CROSS-SECTIONS AND PHOTOELECTRON POLARIZATIONS. Soelve Hultberg, Bengt Nagel, and Per Olsson (Royal Inst. of Tech. and Univ. of Stockholm). Arkiv Fysik, 20: 555-7(1962). (In English)

Computer determinations of the differential and total photoelectric cross sections, and of the photoelectron polarization as a function of the incident photon polarization, are carried out correct to any order in aZ. A pure Coulomb potential is used, and the radial matrix elements are written in terms of hypergeometric functions of two variables. The series expansions of these functions are theoretically convergent for all energies; but computer, time, and program limitations require an upper energy limit of 800 to 1000 kev for Z = 92, the upper energy limit decreasing with increasing Z. No account is taken of screening effects. (T.F.H.)

24295 DYNAMIC PROGRAMING AND THE VARIATIONAL PRINCIPLES OF CLASSICAL AND STATISTICAL MECHANICS. Robert Kalaba (RAND Corp., Santa Monica, Calif.). Develop. Mech., 1: 1-9(1961).

A new approach to problems in the calculus of variations is provided by the functional equation technique of dynamic programing. Some of the applications of these techniques are explored in the analysis of dynamic processes characterized by the principle of least action, and static processes characterized by the principle of minimal potential energy. Since optimal processes involving stochastic elements are also amenable to such treatment, the determination of most likely trajectories through phase space is also discussed. (auth)

24296 IONIZING COLLISIONS OF METASTABLE HELIUM ATOMS IN GASES. William Paul Sholette (Univ. of Florida, Gainesville). Dissertation Abstr., 22: 3430 (Apr. 1962).

A molecular beam method was employed to measure ionization cross sections for collisions of metastable helium atoms in various gases. A cylindrical beam of thermal energy metastable atoms, produced by electron bombardment of helium gas, was passed through a scattering chamber containing the scattering gas at pressures of the order of 10^{-3} mm Hg. Ions produced in the gas by inelastic collisions were detected at a metal electrode, and unscattered or elastically scattered metastable atoms were detected by observing the electrons they ejected from metal surfaces. From the ratios of the ion current to the total current, ionization cross sections in A^2, σ_i, were calculated. Ionization cross sections were measured for each of the metastable states of helium in argon, krypton, xenon, hydrogen, oxygen, nitrogen, and carbon monoxide. Within the experimental error of the measurements, the cross sections for the 2^1S and 2^3S states of helium were the same in all cases except that of hydrogen. The results are discussed in terms of energetically possible ionization processes for each gas, the energy excess, ΔE, for these processes, and the size of the scattering atoms or molecules. For the rare gases, the results indicated that the size of the struck particle is the primary factor in determining the cross section for ionization, rather than the energy excess. In the case of the diatomic molecules, an additional consideration, that of the number and type of ionization processes possible, was also found to be important.

24297 APPLICATION OF THE FAST CYCLOTRON WAVE OF A MAGNETICALLY FOCUSED ELECTRON BEAM TO FREQUENCY MULTIPLICATION. Dean Trafford Davis (Ohio State Univ., Columbus). Dissertation Abstr., 22: 3578(Apr. 1962).

Transverse excitation of a magnetically focused electron beam produces transverse velocity modulation components which propagate along the electron beam in two fundamental modes called the fast and the slow cyclotron waves. The phase velocities of propagation for these waves are given by $u_{1,2} = [u_0/1 \pm (\omega_c/\omega)]$, where u_0 is the axial velocity of the electron beam, ω_c is the angular electron cyclotron frequency, and ω is the angular frequency of the excitation. If $\omega = \omega_c$, the phase velocity of the fast wave becomes infinite, and electrons all along the beam rotate in phase with the modulating field. Electrons initially in an accelerating field will remain in an accelerating field, increasing their kinetic energies and radii of rotation, while those in a decelerating field will give up energy and decrease their radii of rotation, eventually moving to the axis of rotation near the center of the beam from which they can be moved only by an accelerating field. Thus the electron beam will leave the region of transverse excitation rotating about its original axis with the kinetic energy of rotation representing the energy delivered to the beam by the high frequency field. If this rotating beam is passed through a magnetron-type resonator having 2k cavities tuned to the kth harmonic of the cyclotron frequency, the beam can induce a harmonic current in the resonator and can move continuously in a retarding phase of the resulting electric field, since it will pass one resonator during every half cycle of the harmonic frequency. Under these conditions, the rotational kinetic energy of the electron beam can be converted into r-f energy at the harmonic, and thus the device will act as a frequency multiplier. A multiplier of this type was investigated. A third harmonic version produced 28 milliwatts of output power at 29,100 Mc with 9700 Mc excitation of the order of 100 watts. Theoretical analysis indicates that this conversion efficiency should be improved by nearly two orders of magnitide by use of a proper electron gun, and possibilities for generating several hundred milliwatts in the three millimeter wavelength range seem favorable.

24298 LARGE SIGNAL ANALYSIS OF ELECTRON INTERACTION IN KLYSTRON GAPS. Ernest Eugene Erickson (Univ. of Florida, Gainesville). Dissertation Abstr., 22: 3578-9(Apr. 1962).

A theoretical study is presented of the interaction between a modulated electron beam and the output gap of a Klystron amplifier. The main objective is to study the effects of large gap voltage and the presence of secondary charges on the beam loading characteristics of the output gap. An equivalent beam loading conductance and susceptance are defined for the study. General equations applicable to the study of gridded gaps are derived and a numerical method of solution is implemented on an electronic computer to obtain data concerning the effects of varying several gap parameters on the beam loading characteristics of the gap. The results are presented in graphical form and discussed. It was found that the beam loading conductance of the output gap with secondaries present increases with an increase in the secondary factor and also with an increase in input signal. The beam loading due to the secondaries is less than that given by Bernstein's secondary beam loading theory whereas the primary beam loading is much greater than that predicted by the small signal theory. An extension of beam loading theory is made to include the effects of secondary charges at large gap voltages.

24299 ELECTRON BUNCHING IN LONG TRANSIT ANGLE CAVITIES. Charles William Turner (Stanford Univ., Calif.). Dissertation Abstr., 22: 3586-7(Apr. 1962).

The properties of a long-gap cavity are investigated, both theoretically and experimentally, with particular reference to the possible realization of a high-efficiency electron buncher suitable for a klystron-type device employing this form of cavity. Following the promise shown by an exploratory graphical treatment, further ballistic analysis confirmed that a homogeneous axial electric field, several electronic wavelengths in length, will indeed produce satisfactory bunching of an electron beam. The bunching predicted is of the same magnitude as obtained from Webster theory for a conventional two-cavity klystron using a drift space, the r-f beam current varying as $J_1(X)$. However, the bunching parameter X, to first order, depends only upon α, the ratio of r-f cavity voltage to the d-c beam voltage, and yields a maximum for the r-f current at the long-gap cavity exit plane when α is about 3.7.

The r-f beam velocity is a function of both α and D, the normalized transit angle, and can therefore be adjusted independently of the r-f beam current. This has a twofold significance: firstly, the velocity dispersion in the beam can be minimized by a suitable choice of D, thus ensuring that maximum possible conversion efficiency is obtained at the output gap; secondly, the velocity dispersion can be adjusted so that further drifting beyond the long-gap cavity augments the bunching already produced. The theory shows that the latter scheme is capable of achieving bunching efficiencies approaching those obtained in three-cavity klystrons. The introduction of space-charge effects immediately places restrictions upon the transit angles which can be usefully employed in such systems, due to the space-charge debunching, and at least on a small-signal basis the analysis yields results not significantly different from those familiar in conventional klystron theory. Beam loading effects for the long-gap cavity, their dependence on transit angle, signal amplitude, and space charge are also considered. From a practical viewpoint the negative conductance regions are of most interest; their use in monotron-type oscillators is well known. The behavior of this form of microwave generator is analyzed in the light of the results of the bunching analysis, being particularly concerned with the detrimental effects of space charge and the determination of the optimum magnitude of oscillations. The experimental results satisfactorily confirm the dependence of r-f beam current upon α; measurements of r-f current indicate that at least under quasi-ballistic conditions bunching efficiencies close to those expected can be obtained with the two bunching systems considered. The measurements of the beam-loading characteristics demonstrated that much useful information concerning the design of an efficient bunching system can be obtained from these results. In particular they indicated that an oscillator of very useful efficiency can be achieved by using the monotron-buffer principle. The conclusions, in reviewing the experimental and theoretical work, underline the advantages to be derived from the use of long-gap cavity bunching at millimeter wavelengths, both for harmonic generation and frequency multiplication.

24300 DETERMINATION OF VIBRATIONAL FORCE FIELDS IN POLYATOMIC MOLECULES AND AN APPLICATION TO THE DEUTEROETHANES. Robert LeRoy Hubbard (Univ. of North Carolina, Chapel Hill). Dissertation Abstr., 22: 3703(Apr. 1962).

A method is given to find the vibrational force field for a family of molecules. Partial derivatives of characteristic frequencies with respect to force constants are calculated. These partial derivatives remain nearly constant for small changes in the assumed force field. A least squares procedure gives a refined force field to obtain the best fit between calculated and observed frequencies. The constraints imposed on the general force field by redundant coordinates are discussed. Redundancy conditions for certain carbon-containing groups are calculated explicitly. An application is made to the isotopic ethanes. The general quadratic force field of twenty-two independent constants is determined by fitting calculated frequencies to 128 observed frequencies assigned from ten isotopic varieties, and experimental results are reproduced with a 1.1 per cent standard deviation. Characteristic frequencies are predicted for the four remaining deuteroethanes.

24301 CHARGE DEPENDENT EFFECTS ON NUCLEAR FORCES. Duo-Liang Lin (Ohio State Univ., Columbus). Dissertation Abstr., 22: 3709(Apr. 1962).

By taking into account the different masses of the charged and the neutral pions, nuclear potentials of the Brueckner and Watson type are obtained up to the fourth order in a perturbation expansion. The pair terms are completely suppressed following the argument of Klein. These potentials are then employed to calculate the charge dependence of the ^{1}S-scattering lengths a_{np} and a_{pp}, and the first excited T = 1 state of Li^6. The three coupling constants for pion-nucleon systems $f_{\pi N}$, f_{cp} and f_{cn}, together with the hard core radius r_0, are treated as open parameters to be fixed by empirical data. It is found that for both r_0 = 0.3 and 0.4 Fermi, the coupling constants are very close to one another except for a small deviation from charge symmetry. The scattering length for the neutron-neutron system in the ^{1}S- state, a_{nn}, is predicted, by using the different coupling constants thus obtained, to be 1 to 6 per cent smaller than a_{pp}. In addition to these, a rough estimate was made of the proton and the neutron potential well depths inside a nucleus of intermediate size. It is found that the proton has a slightly deeper well than the neutron but the difference is only about 0.02 per cent.

24302 OCTUPOLE VIBRATIONS OF SPHEROIDAL EVEN-EVEN NUCLEI. Pertti Olavi Lipas (Rensselaer Polytechnic Inst., Troy, N. Y.). Dissertation Abstr., 22: 3709(Apr. 1962).

A theory is proposed for the low-lying odd parity states in deformed even-even nuclei in terms of collective octupole vibrations of the nuclear surface. As an introduction, the problem of quadrupole vibrations in spheroidal even-even nuclei is reviewed in analytical detail within the context of the Bohr-Mottelson model. With the octupole degrees of freedom corresponding to the spherical harmonics Y_{30} and $Y_{3\pm2}$, or with those corresponding to $Y_{3\pm1}$ and $Y_{3\pm3}$, the Hamiltonian obtained with the hydrodynamic moments of inertia is found to separate into a rotational and a vibrational part. Either pair of octupole degrees of freedom is combined with the usual quadrupole degrees of freedom, β and γ, and small oscillations about a spheroidal equilibrium shape are considered. The arbitrarily restricted choice of the octupole degrees of freedom can be supported only by direct comparison with experiment. With the choice of Y_{30} and $Y_{3\pm2}$ as the octupole degrees of freedom, the Schrödinger equation immediately yields the usual β vibrational state with a superimposed rotational band (K = 0, I = 0+, 2+, 4+,...) and a "b vibrational" state with a superimposed rotational band (K = 0, I = 1-, 3-, 5-,...). The remaining equation is solved formally as a degenerate perturbation problem. The result gives rise to two vibrational states with K = 2, which are interpreted as the γ vibration (even parity) and a "g vibration" (odd parity); the associated rotational bands both have I = 2, 3, 4,... . Bands associated with higher vibrational states are also considered. The case of $Y_{3\pm1}$ and $Y_{3\pm3}$ as the octupole degrees of freedom is developed to the point where the remaining problem is purely mathematical. The resulting linear partial differential equation apparently requires a numerical solution. Perturbation corrections to the moment of inertia are calculated for the quadrupole-octupole case with the Y_{30} and $Y_{3\pm2}$ degrees of freedom. The reduced E1, E2, and E3 gamma transition probabilities are calculated for all possible transitions between the bands (M1 transitions are forbidden). The model with Y_{30} and $Y_{3\pm2}$ as the octupole degrees of freedom predicts the K = 0- and K = 2- bands observed in deformed even-even nuclei. Theoretical and experimental values for J/J_{gr}, where J is the moment of inertia in a vibrational band and J_{gr} is the ground state moment of inertia, are in fair agreement. Otherwise, few meaningful quantitative comparisons can be made due to the sparsity of experi-

mental data on the higher vibrational states and on gamma transitions between the bands.

24303 ON THE VALIDITY OF THE REVISED ROTATIONAL CONSTANTS OF $\alpha(C \rightarrow X)$ BAND SYSTEM OF ZrO. N. Sreedhara Murthy (Karnatak Univ., Dharwar, India). Indian J. Phys., 36: 101-4(Feb. 1962).

The values of the rotational constants of the α $(C \rightarrow X)$ system of ZrO are analyzed on the basis of a theory involving the intensity aspects. (auth)

24304 SYMMETRY OF THE CRYSTALLINE ELECTRIC FIELD ON Yb^{+++} ION IN $Yb_2(SO_4)_3 \cdot 9H_2O$ CRYSTAL. A Mookherji and D. Neogy (Agra College, India). Indian J. Phys., 36: 107-9(Feb. 1962).

The anisotropy of the magnetic susceptibility $(K_{||} - K_{\perp})$ and the square of the magnetic moment (μ^2) are calculated for $Yb_2(SO_4)_3 \cdot 8H_2O$ at 100 to 300°K, for several sets of assumed crystalline field parameters. It is assumed in the calculations that the 8 H_2O molecules surrounding the ion have general tetragonal symmetry. A set of crystal parameters is found for which the experimental and calculated values of $(K_{||} - K_{\perp})$ and μ^2 closely parallel one another. (T.F.H.)

24305 CHARACTERISTICS OF SOLAR ENERGETIC PARTICLES WHICH EXCITE POLAR-CAP BLACKOUTS. Kenji Sinno (Hraiso Radio Wave Observatory, Japan). J. Geomagnet. Geoelec., 13: 1-10(1961). (In English)

Ejection and propagation of the particles that excite abnormal ionization in the polar upper atmosphere are investigated from some statistical considerations on ionospheric data and cosmic radio observation by riometer. Relations between the flares and the polar-cap blackouts delineate the mechanism for trapping of particles into the cloud, which is responsible for the geomagnetic disturbances: that is, a part of the energetic particles ejecting from the flare propagate with relativistic velocity in interplanetary space along the twisted solar magnetic line of force extending to the earth, and excite the S-type polar-cap blackouts having sudden onset within a few hours after the flare; and another part of the energetic particles ejecting from the flare is trapped into the cloud and is carried with rather low velocity, then the particles reach the earth by leaking from the cloud and excite the G-type polar-cap blackouts having gradual onset about 10 hours before commencement of geomagnetic storms. (auth)

24306 THE SOLAR GEOPHYSICAL EVENTS OF NOVEMBER 1960. Tatsuzo Obayashi (Arctic Inst. of North America, Washington, D. C.). J. Geomagnet. Geoelec., 13: 11-25(1961). (In English)

Measurements of solar phenomena, cosmic rays, ionosphere, geomagnetism, and aurorae are summarized. A theoretical model is presented for disturbances, which appears to be consistent. It is shown that the events of November 1960 are unique in that they provide not only information on solar particles up to cosmic-ray energy ranges, but also on interplanetary magnetic fields. Some discoveries made in the events are described briefly. (auth)

24307 GEOMAGNETIC STORM EFFECTS ON CHARGED PARTICLES. Tatsuzo Obayashi (Kyoto Univ.). J. Geomagnet. Geoelec., 13: 26-32(1961). (In English)

The entry of high energy charged particles is studied taking into account the effect of field distortion arising from a geomagnetic storm. By using a modified version of Störmer's theory, the cut-off rigidities of incoming particles are computed for two models of the outer geomagnetic field. The result is compared with the observed effect on precipitation of solar and galactic cosmic rays during the initial and main phases of a geomagnetic storm. (auth)

24308 INTERACTION BETWEEN AN OBLIQUELY INCIDENT PLANE ELECTROMAGNETIC WAVE AND AN ELECTRON BEAM IN THE PRESENCE OF A STATIC MAGNETIC FIELD OF ARBITRARY STRENGTH. K. H. B. Wilhelmsson (Chalmers Univ. of Tech., Göteborg). J. Research Natl. Bur. Standards, 66D: 439-51(July-Aug. 1962).

The interaction between an obliquely incident plane electromagnetic wave and an electron beam is studied theoretically. A static magnetic field of arbitrary strength is assumed to be present in the axial direction. Machine computations made for the case of a cylindrical electron plasma show that resonances occur in the backscattering cross section as a function of the angle of incidence of the plane wave. The dependence of the resonance angles on the plasma frequency for fixed gyrofrequency suggests a possibility of utilizing the results of the investigation for diagnostics of a cylindrical plasma. (auth)

24309 A POSSIBILITY OF PREPARING OVERHEATED SOLID STATE IN REACTORS. Tibor Hoffmann. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 262-74(July-Aug. 1958). (In Hungarian)

The size of subcrystallites and the vacancy concentration can be related to the energy-entropy diagram of a solid. Taking into account only the entropy of mixing of atoms with vacancies, energy-entropy curves are obtained for each subcrystallite size. For small subcrystallites these curves have positive curvature throughout; for larger subcrystallites, however, the curves have two points of inflection. The curve has a double tangent in this case. Since the differential quotient of the energy-entropy curve is the absolute temperature, the double tangent denotes that at this temperature the system has two stable phases, each with a characteristic entropy. This temperature is the melting point. The vacancy concentration of the lower point of contact of the tangent is shown to be about 1.5%. Considering the curve between the tangents there seems to be no common thermodynamic way to reach this section of the curve. However, if vacancies could be generated very rapidly at a somewhat lower temperature than the melting point, it could be possible to reach a vacancy concentration higher than the critical one without melting. The procedure should be, therefore: irradiate the sample by a sufficiently high neutron flux to get the desired concentration of vacancies, holding the sample during the irradiation at a temperature below the melting point; and suddenly raise the temperature above the melting point after the critical value of vacancies is reached. The sample so handled is assumed to be stable at this higher temperature without melting. There seems to be a quite broad range of temperature on which this assumption is justified; the lower end of this temperature interval is the melting point, where the solid regains its normal properties, and the upper end is in a domain where curious thermodynamic properties are found, e.g., a negative specific heat, etc. The recombination process and the generation of interstitial defects by the irradiation are not taken into account, so a very crude approximation is obtained for the value of the necessary irradiation. (auth)

24310 POTENTIAL SCATTERING FOR COMPLEX ENERGY AND ANGULAR MOMENTUM. A. Bottino, A. M. Longoni, and T. Regge (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10), 23: 954-1004(Mar. 16, 1962). (In English)

The analytic properties of the partial-wave scattering amplitude for potential scattering in the pair of variables k (wave number) and $\lambda = l + \frac{1}{2}$ are derived when both variables are complex. Several results on the location of the poles of the S-matrix follow from a procedure of analytic completion. The scattering process is then considered as described by the variables λ and k, instead of s and t, as in the Mandelstam formalism. The set of properties of $S(\lambda,k) = \exp[2i\delta(\lambda,k)]$ derived is exactly equivalent to the double dispersion formulas for energy and momentum transfer. (auth)

24311 VAPOUR PRESSURE OF ISOTOPIC SOLIDS BY A STEADY FLOW METHOD: ARGON BETWEEN 72°K AND TRIPLE POINT. G. Boato, G. Scoles, and M. E. Vallauri (Università, Genoa and Istituto Nazionale di Fisica Nucleare, Genoa). Nuovo cimento (10), 23: 1041-53(Mar. 16, 1962). (In English)

A steady-state flow method is devised to measure the single-stage separation factor in the solid-vapor equilibrium. The method is applied to the $A^{36}-A^{40}$ solid system. The logarithm of the separation factor is found to depend linearly on T^{-2} within the experimental errors, ranging from 0.0104 at 72°K to 0.0072 at the triple point. This linear dependence is in agreement with theories of small quantum effects on thermodynamic systems. Using a certain formulation of the theory and taking into account anharmonic effects, the value of the mean square frequency of the lattice harmonic vibrations in solid argon is derived; this value agrees with specific heat measurements. The difference in triple point temperatures of A^{40} and A^{36} is derived from the measurements and found to be 0.043°K. (auth)

24312 ON THE EXTRAPOLATION OF THE EXPERIMENTAL SCATTERING AMPLITUDE TO THE SPECTRAL FUNCTION REGION. I. Ciulli, S. Ciulli, and J. Fischer (Joint Inst. for Nuclear Research, Dubna, USSR). Nuovo cimento (10), 23: 1129-32(Mar. 16, 1962). (In English)

A technique is described, within the framework of the conformal mapping approach, for extrapolating experimental scattering amplitudes in order to obtain the spectral function. Divergence problems on cuts in the complex $\underline{z}$-plane are discussed. A function is found whose expansion into $\underline{w}^n(z)$ is convergent, and which can thus be used in the calculation of the spectral function ($\underline{w}(z)$ is any function that is real for $-1 < \underline{w} < 1$ and analytical on the unit circle in the complex $\underline{w}$-plane, and $\underline{n}$ is an integer). The spectral function is represented in this calculation as a convergent Fourier series. (T.F.H.)

24313 SPIN-LATTICE RELAXATION IN TWO RARE EARTH DOUBLE NITRATES. R. P. Hudson and B. W. Mangum (National Bureau of Standards, Washington, D. C.). Nuovo cimento (10), 23: 1133-5(Mar. 16, 1962). (In English)

Spin-lattice relaxation is measured in cerous and neodymium magnesium nitrates (CMN and NMN respectively), by low audio-frequency measurements of the susceptibility in fields up to 1 kOe, at about 1 to 5°K. The relaxation time (τ) in NMN is found to vary as T^{-3}, and τ for CMN is found to depend on T^{-1} with a small admixture of T^{-5} to T^{-9}. The interpretation of these results in terms of phonon processes is discussed. (T.F.H.)

24314 THE EVOLUTION EQUATION FOR THE HOMOGENEOUS CRYSTAL. L. Blum (Facultad de Ciencias Exactas y Naturales, Buenos Aires). Nuovo cimento (10), 26: 765-73(June 1, 1962). (In English)

A method for the exact summation of the diagrams in the time-dependent perturbation series is applied to the derivation of the evolution equation for the homogeneous crystal. This equation is given as a sum over connected diagrams only. (auth)

24315 CO-ORDINATE CONDITIONS FROM VARIATIONAL PRINCIPLES. A. A. Evett (Univ. of Arizona, Tucson). Nuovo cimento (10), 24: 933-9(June 1, 1962). (In English)

Co-ordinate conditions arising from the requirement of yielding a metric tensor that best approximates a Minkowski metric tensor are obtained and applied to several spaces. Another set of co-ordinate conditions are derived by considering the co-ordinates to be comoving co-ordinates of a fictitious fluid and finding those co-ordinate systems having minimum total intrinsic rotation. None of the commonly-used co-ordinate conditions fall into either of the two categories considered. A variational principle leading to the harmonic co-ordinate conditions is stated, but the associated integral seems to have no fundamental physical or geometrical significance. (auth)

24316 HYPERFINE INTERACTION CONSTANTS OF THE F-CENTER ELECTRON WITH THE LATTICE IN ALKALI HALIDES (WITH NaCl STRUCTURE). T. E. Feuchtwang (Univ. of Illinois, Urbana). Phys. Rev., 126: 1616-27(June 1, 1962).

Using the de Boer model for the F center, expressions for the coupling constants in the hyperfine interaction of the F electron with a nucleus of the lattice are obtained. These constants can be determined experimentally from "electron nuclear double resonance." Comparison of theoretical expressions and the empirical values permits an estimate of the importance of factors determining these coupling constants. The formal similarity between the magnetic dipole-dipole constants and the contribution of the F electron to the electric quadrupole coupling constants is exploited. The measured magnetic constants are used in the discussion of the quadrupole constants. Polarization of the lattice, as a result of displacement of the ions in the first few shells around the negative-ion vacancy, is important in determining the electric quadrupole coupling constant. This qualitatively agrees with Kojima's calculation in LiF; and explains the fact that while the magnetic interaction shows negligible deviation for "axial" symmetry at sites of lower symmetry, this is not true for the electric quadrupole interaction. (auth)

24317 ELECTRON–NUCLEAR DOUBLE RESONANCE SPECTRUM OF AN F-CENTER ELECTRON IN ALKALI HALIDES (WITH NaCl STRUCTURE). T. E. Feuchtwang (Univ. of Illinois, Urbana). Phys. Rev., 126: 1628-35 (June 1, 1962).

From the de Boer model of the F center, a spin Hamiltonian describes the hyperfine interaction of the F-center electron with an arbitrary nucleus in the lattice. This Hamiltonian is used to construct a spin Hamiltonian describing the hyperfine interaction of the F electron with all nuclei in the lattice in the presence of a constant and uniform magnetic field. The electron-nuclear double resonance spectrum for the F electron is deduced. The negative-ion vacancy (in a cubic lattice) is an inversion center, and the magnetic field is a pseudovector. Consequently, nuclei at sites which are mapped into each other by an inversion, in the vacancy are physically equivalent. This entire electron-nuclear double resonance spectrum may be viewed as a set of spectra, each associated with the interaction of the F electron with a particular pair of physically equivalent nuclei. This contrasts with theory assuming that the F electron interacts with individual nuclei. The new theory leads improved agreement between calculated and observed

spectra. The calculated spectrum is sensitive to the relative sign of the nuclear g factor and the electric quadrupole coupling constant. Data can be used to determine the magnitude and the sign of the electric-field gradient at lattice sites close to the F center. (auth)

24318 BLOCH ELECTRONS IN A MAGNETIC FIELD. E. I. Blount (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 126: 1636-53(June 1, 1962).

A formalism is used to simplify Kohn's derivation of an effective Hamiltonian. The derivation is valid for arbitrary symmetry and with the inclusion of spin-orbit effects and for bands with degeneracies. The actual form is obtained to second order in the magnetic field. It is explicitly shown that the procedure is asymptotically convergent. This Hamiltonian is then used to obtain the susceptibility in a convenient form. The nature of the actual energy levels is discussed with attention to the broadening, gaps in the continuous region, and magnetic breakdown. (auth)

24319 ROLE OF ELECTRON-ELECTRON COLLISIONS IN GALVANOMAGNETIC EFFECTS. B. V. Paranjape (Univ. of Alberta, Edmonton, Can.). Phys. Rev., 126: 1668-71(June 1, 1962).

A time of relaxation τ_e giving the rate of approach of a non-Maxwellian distribution to its equilibrium through electron-electron (e-e) collisions alone is assumed. An additional term is introduced in the usual Boltzmann's transport equation to account for the effect of e-e collisions on the distribution function. A solution of the Boltzmann's equation leads to the resistivity and Hall coefficient. In the limit $\tau_e \to \infty$, the formulas reduce to the usual equations. The corrections are small. A systematic study of these effects with different carrier densities should lead to information regarding the role of (e-e) collisions in these effects. The quantity $b = \tau_0/\tau_e$, where τ_0 is the mean time of collision of electrons with lattice vibrations, is measured most easily by observing the changes in Hall constant with increasing magnetic field. (auth)

24320 BOSE-EINSTEIN CONDENSATION OF EXCITONS. John M. Blatt (New York Univ., New York and Univ. of New South Wales, Kensington, Australia), K. W. Boeer, and Werner Brandt. Phys. Rev., 126: 1691-2(June 1, 1962).

Whether quasi-particles, such as excitons, i.e., non-localized excited states of solids, can fulfill necessary conditions for a Bose-Einstein condensation and whether such condensation can be observed are discussed. Although uncertainties of data on excitons preclude precise numerical predictions, it is concluded that under certain experimentally attainable circumstances excitons fulfill the necessary conditions, i.e., condensation is possible. Ways of detecting the condensation are considered, and a specific experiment is proposed. (auth)

24321 FAR INFRARED DIELECTRIC DISPERSION IN $BaTiO_3$, $SrTiO_3$, AND TiO_2. W. G. Spitzer, Robert C. Miller, D. A. Kleinman, and L. E. Howarth (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 126: 1710-21 (June 1, 1962).

The room temperature reflectivity of $BaTiO_3$, $SrTiO_3$, and TiO_2 was measured from 5000 to 70 cm^{-1}. These data were analyzed by the Kramers-Kronig method and by classical dispersion theory. All of the infrared-active fundamental vibrations allowed by crystal symmetry were measured and characterized by their dispersion parameters. The low-frequency mode is responsible for ferroelectricity in $BaTiO_3$ and $SrTiO_3$ and is found at 33.8 and 87.7 cm^{-1}, respectively. The unusually large damping found for this mode can explain the observed microwave loss tangents. The strength of the mode accounts for the large values of the low-frequency dielectric constant. This mode, as well as the highest frequency mode, 510 and 546 cm^{-1} in $BaTiO_3$ and $SrTiO_3$, respectively, is associated with TiO_6 octahedra vibrations. A mode at 183 and 178 cm^{-1} for $BaTiO_3$ and $SrTiO_3$, respectively, was found and assigned to a cation-(TiO_3) vibration. In rutile, three resonances are observed for the ordinary ray and one for the extraordinary ray, as required by theory. As with the titanates, the high dielectric constant is associated with the low-frequency mode. An analysis of the strengths of all of the resonances shows that they involve reasonable effective charges for ionic crystals. (auth)

24322 GROUND STATE OF SOLID He^3. Edward M. Saunders (Stanford Univ., Calif.). Phys. Rev., 126: 1724-36(June 1, 1962).

A ground-state wave function for solid He^3 in the body-centered cubic phase is calculated in the form of a product of single-particle orbitals and pair correlations. The correlation part is an eigenfunction of the Pluvinage Hamiltonian with each pair in a state of zero energy in a frame in which their center of mass is at rest. Assuming that exchange effects are small, an approximate single-particle probability function is obtained from this wave function. The many-body energy is obtained from this single-particle probability function from basic principles by a plausibility argument, and leads to a pressure-volume relation that agrees with observation. Exchange effects arise from the original wave function when suitably antisymmetrized. This predicts an exchange energy of about 0.005°K near the melting curve, this favors antiferromagnetic alignment. (auth)

24323 DRIFT VELOCITY AND ANISOTROPY OF HOT ELECTRONS IN n GERMANIUM. H. G. Reik and H. Risken (Philips Research Labs., Aachen). Phys. Rev., 126: 1737-46(June 1, 1962).

The drift velocity and the angle between the direction of the drift velocity and the electric field are calculated as a function of the electric field strength, the crystal orientation, and the lattice temperature. The fit between experimental and theoretical results is nearly quantitative. The optical deformation potential constant D_0 and the intervalley rate constant w_2 are determined. The values $D_0 = 0.5 \times 10^9$ ev/cm and 1.66×10^{10} $sec^{-1} \leq w_2 \leq 10^{11}$ sec^{-1} are consistent with the results of independent experiments. (auth)

24324 SECOND-ORDER HYPERFINE AND ZEEMAN CORRECTIONS FOR AN (sl) CONFIGURATION. A. Lurio (International Business Corp., New York), M. Mandel, and R. Novick. Phys. Rev., 126: 1758-67(June 1, 1962).

The complete Zeeman and hyperfine (dipole, quadrupole, and octupole) matrices are given for an (sl) configuration in intermediate coupling. From these are derived the second-order corrections to the zero-field hyperfine intervals for an (sp) configuration. Corrections appropriate to the crossing of certain of the hyperfine Zeeman levels of an (sp) $^3P_1$ state for atoms with spin-$\frac{1}{2}$ and spin-$\frac{3}{2}$ nuclei are obtained. (auth)

24325 DIFFUSION OF SLOW ELECTRONS IN GASES. L. W. Cochran and D. W. Forester (Oak Ridge National Lab., Tenn.). Phys. Rev., 126: 1785-8(June 1, 1962).

The diffusion of slow electrons in hydrogen, nitrogen, carbon dioxide, methane, ethylene, and cyclopropane in uniform electric fields was investigated for ratios of electric field to pressure from 0.2 to 5.0 (v/cm)/mm Hg. Such measurements lead to a determination of the ratio of electron drift velocity to diffusion coefficient. By assuming a distribution in velocity of the electrons in the swarm, the Townsend energy factor k_T and the mean electron velocity can be computed as a function of E/P, where E is the elec-

ric field and P is the gas pressure. Where the electron drift velocity is also known, the mean free path at unit pressure, the average energy loss per collision, and the gas kinetic cross section can be calculated. The results are presented in tabular form. (auth)

24326 THREE-DIMENSIONAL GEOMETRY AS CARRIER OF INFORMATION ABOUT TIME. Ralph F. Baierlein (Princeton Univ., N. J.), David H. Sharp, and John A. Wheeler. Phys. Rev., 126: 1864-5(June 1, 1962).

A geometry of curved empty space which evolves in time in accordance with Einstein's field equations may be termed a "geometrodynamical history." Such a history can be specified by giving on a 3-dimensional space-like hypersurface ("initial surface") the geometry intrinsic to this surface and the extrinsic curvature of this surface (having to do with how the surface is imbedded, or is to be imbedded, in a yet-to-be-constructed 4-dimensional manifold). The intrinsic and extrinsic curvatures of the surface cannot be specified independently but have to satisfy the initial value equations of Foures and Lichnerowicz (analogous to div E = 0 and div B = 0 in electromagnetism). An alternative way of specifying a history is outlined in which the intrinsic geometry is given freely on each of 2 hypersurfaces, and nothing is specified as to the extrinsic curvature of either. In the special case in which the two so-specified 3-geometries are nearly alike, a procedure is outlined in order to find the following from Einstein's equations: the invariant space-time interval between an arbitrary point on one surface and a nearby point on the other surface (and thus the 4-geometry interior to the thin sandwich); the extrinsic curvature of the sandwich; hence (via the rest of Einstein's equations) the entire enveloping 4-geometry or geometrodynamical history); and the time-like separation of the original surfaces and their location in spacetime. In this sense, two 3-geometries carry latent information about time. (auth)

24327 EXPERIMENTS WITH NEUTRON SCINTILLATORS MADE OF LITHIUM FLUORIDE, ZINC SULFIDE, AND LUCITE. Friedrich H. Helm (Argonne National Lab., Ill.). Rev. Sci. Instr., 33: 687-8(June 1962).

Neutron scintillators were made by heating and pressing a mixture of LiF, ZnS(Ag), and Lucite in a weight ratio of 2:1:1. Several scintillators were prepared with different corrugation patterns and with or without Li^6 enrichment. Tests were carried out with the scintillators attached to photomultiplier tubes and with a slow neutron source. A plot of counting rate vs discriminator setting is given. A top efficiency of 28% was obtained for a Li^6F scintillator with a corrugation angle of 60°. (D.L.C.)

24328 ON THE MECHANISM OF THE EXTERNAL PHOTOEFFECT FROM MASSIVE PHOTOCATHODES UNDER THE ACTION OF X RAYS. M. A. Rumsh, V. N. Shchemelev, and Kh. Prois (Leningrad State Univ.). Soviet Phys.-Solid State, 4: 49-51(July 1962).

A formula proposed for determining the quantum yield of the external photoeffect of massive photocathodes bombarded by x rays is critically discussed. The primary photoelectrons and the Auger electrons are separately taken into account. The spectrum intervals for which photoelectrons and Auger electrons are of decisive importance respectively are determined. The spectral dependence of the quantum yield is determined precisely on the basis of experimental data on the wavelength dependence of the average absorption coefficient for photoelectrons. (auth)

24329 PLASMON SPECTRA IN In AND InSb. L. A. Balabanova, M. M. Bredov, and B. A. Kotov (Inst. of Semiconductors, Leningrad). Soviet Phys.-Solid State, 4: 60-2 (July 1962).

The spectra of the characteristic electron energy losses in thin films of In and InSb were measured. An attempt was made to interpret the spectra from the standpoint of the theories of plasma oscillations and of interband transitions. A technique is suggested for studying characteristic losses in order to investigate electron energy spectra in solids. (auth)

24330 STUDY OF THE DISORIENTATION OF MOSAIC BLOCKS BY MEASUREMENT OF SMALL-ANGLE X-RAY SCATTERING. V. I. Betekhtin and A. I. Slutsker (Ioffe Inst. of Physics and Tech., Leningrad). Soviet Phys.-Solid State, 4: 94-8(July 1962).

A résumé is given of the theory of double reflections of x rays from pairs of slightly disoriented crystal regions; this disorientation is one of the causes of small-angle scattering of x rays in polycrystalline bodies. Experimental conditions necessary for the study of the disorientation of mosaic blocks by this method are analyzed. Finally, the results of measurements of scattering at small angles in samples of aluminum subjected to annealing at different temperatures and to deformation are given. On the basis of the experimental data, the distribution function of the orientations of mosaic blocks is calculated and its dependence on the treatment of the aluminum samples is found. (auth)

24331 GALVANOMAGNETIC PHENOMENA IN SEMICONDUCTORS WITH ANISOTROPIC ELECTRON SCATTERING. I. Ya. Korenblit (Inst. of Semiconductors, Leningrad). Soviet Phys.-Solid State, 4: 120-6(July 1962).

A theory of galvanomagnetic phenomena is developed for the case of electron scattering by ionized impurities having an anisotropic energy distribution. The expressions found for the galvanomagnetic coefficients are in the form of rapidly converging series. (auth)

24332 ON THE POSSIBILITY OF SUPERCONDUCTIVITY IN SEMICONDUCTORS. V. L. Gurevich, A. I. Larkin, and Yu. A. Firsov (Inst. of Semiconductor, Leningrad). Soviet Phys.-Solid State, 4: 131-4(July 1962).

The possibility of a semiconductor experiencing a transition into the superconducting state is analyzed. It is shown that in nonpolar semiconductors such a transition cannot take place if the carrier concentration $n \leq 10^{19}$ since, as a result of the low density of electronic states in the vicinity of the Fermi surface, the phonon-induced attraction between electrons is lower than their Coulomb repulsion. In polar nonpiezoelectric semiconductors the transition can occur only if the Fermi energy is much higher than the limiting frequency of longitudinal optical vibrations. The condition under which the transition can occur is derived; it is shown that it is more likely to occur if the coupling between electrons and lattice vibrations is strong. The condition for existence of a superconducting transition in piezoelectric semiconductors of the indium antimonide type is also determined. (auth)

24333 MAGNETIC SCATTERING OF SLOW NEUTRONS IN DILUTE ALLOYS OF A TRANSITION METAL WITH A SIMPLE METAL. Yu. A. Izyumov (Inst. of Metal Physics, Sverdlovsk, USSR). Soviet Phys.-Solid State, 4: 158-61 (July 1962).

The magnetic scattering cross section is calculated for slow neutrons in a dilute alloy of a transition metal with a simple metal. It is shown that as a result of the exchange interaction between spin-unsaturated shells of transition element atoms and conduction electrons, the effective mag-

netic form factor of the atoms changes appreciably. The spatial distribution of the spin polarization of conduction electrons near paramagnetic atoms in the alloy can be determined from neutron diffraction measurements. (auth)

24334 ELECTRON PARAMAGNETIC RESONANCE AND OPTICAL SPECTRA FOR Yb^{3+} IONS IN CdF_2. V. K. Konyukhov, P. P. Pashinin, and A. M. Prokhorov (Lebedev Inst. of Physics, Moscow). Soviet Phys.-Solid State, 4: 175-6(July 1962).

The absorption spectrum for Yb^{3+} ions in the CdF_2 lattice in the far infrared region is studied, and two $2F_{\frac{5}{2}} - 2F_{\frac{7}{2}}$ transition lines located at 0.961 and 0.972 μ are observed. Investigation of the Yb^{3+} paramagnetic resonance spectrum at three different frequencies with variation of the g-factor permits an estimation of the order of ground state splitting. A value of $[21.1 \pm 0.4]$ cm^{-1} is obtained for the distance between the lowest state level. The spin-lattice relaxation time is found to be inversely proportional to the temperature in the region of liquid helium temperatures, and is equal to 3.7×10^{-4} sec at 1.8°K. (auth)

24335 ANGULAR DISTRIBUTION OF SECONDARY ELECTRONS FOR AN EFFECTIVE EMITTER CONSISTING OF AN MgO FILM ON A CuAlMg ALLOY BASE. V. A. Alekseev and V. L. Borisov. Soviet Phys.-Solid State, 4: 191-5(July 1962).

The angular distributions of groups of true secondary electrons and of inelastically and elastically reflected electrons are investigated for an MgO emitter on a CuAlMg base. The angular distribution of the true secondary electrons is in approximate correspondence with the cosine law. The current-voltage characteristics of the true secondary electron current are investigated for various electron angles. (auth)

24336 THE MEASUREMENT OF ISOTOPE SHIFTS AND HYPERFINE STRUCTURE IN THE 1-3 μ REGION. R. Beer (University, Manchester, Eng.) and L. Bovey. Spectrochim. Acta, 18: 927-31(July 1962).

The determination of isotope shifts in $Pu^{240} - Pu^{239}$ and of hyperfine structure in U^{233} is reported. The value of such information for identification of energy levels in actinide elements is discussed. (auth)

24337 LIQUID SCINTILLATION MEASUREMENTS. Hans G. Forsberg (Isoptekniska Laboratoriet, Stockholm). Svensk Kem. Tidskr., 74: 144-63(1962). (In Swedish)

The physical background of the liquid scintillation process is described, together with practical aspects of measuring techniques. Examples are given of the use of liquid scintillation counting of radioactive tracers in archeology, in meteorology and hydrology, in chemical and physical research, and in biology and medicine. The liquid scintillation method is compared with other methods for counting liquid samples of H^3, C^{14}, S^{35}, Ca^{45}, and Cl^{36}. (auth)

24338 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY 1962 ANNUAL MEETING BOSTON, MASSACHUSETTS JUNE 18-21, 1962. John H. Martens, ed. Trans. Am. Nuclear Soc., 5: No. 1, 1-272(June 1962).

Summaries of 315 papers are included; the title of each is listed in NSA. For the users convenience all titles have been listed in this subject category. Where other subject categories would be more appropriate, cross references have been used. Complete author and subject indexes have been prepared. In the event the complete papers are published later, they will be announced in NSA. (D.E.B)

24339 TRANSCURIUM AND FUTURE TRANSACTINIDE ELEMENTS. Glenn T. Seaborg (U. S. Atomic Energy Commission, Washington, D. C.). Trans. Am. Nuclear Soc., 5: No. 1, 13(June 1962).

24340 PRODUCTION OF THE TRANSURANIUM ELEMENTS. W. D. Burch, E. D. Arnold, and A. Chetham-Strode (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 14-15(June 1962).

24341 THE HIGH FLUX ISOTOPE REACTOR. C. E. Winters (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 15(June 1962).

24342 CHEMICAL PROCESSING REQUIREMENTS FOR TRANSURANIUM ELEMENT PRODUCTION. R. E. Leuze (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 16-17(June 1962).

24343 AMERICIUM-CURIUM RECOVERY FROM PLUTONIUM PROCESS WASTE. M. H. Lloyd (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 17(June 1962).

24344 SEPARATION OF TRANSURANIUM ELEMENTS FROM RARE EARTHS BY TERTIARY AMINE EXTRACTION. R. D. Baybarz, Boyd Weaver, and H. B. Kinser (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 17-18(June 1962).

24345 SEPARATION OF TRANSURANIUM ELEMENTS BY PHOSPHONATE EXTRACTION. R. D. Baybarz (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 18-19(June 1962).

24346 SOME RECENT DEVELOPMENTS IN FISSION PHYSICS. R. B. Leachman (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nuclear Soc., 5: No. 1, 19-20(June 1962).

24347 RATIO OF SYMMETRIC TO ASYMMETRIC FISSION FOR RESONANCE NEUTRON FISSION OF U-235. L. E. Glendenin, K. F. Flynn, and L. M. Bollinger (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 20-1(June 1962).

24348 ON THE SPIN DEPENDENCE OF THE FISSION WIDTHS AND THE FISSION PRODUCT MASS DISTRIBUTION. M. S. Moore (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 21-2(June 1962).

24349 VARIATION IN U-235 MASS YIELDS AT NEUTRON ENERGIES BELOW 0.5 ev. K. T. Faler and R. L. Tromp (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 22(June 1962).

24350 ENERGETICS OF CHARGED PARTICLES INDUCED FISSION REACTIONS. H. C. Britt, H. E. Wegner, and J. Gursky (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nuclear Soc., 5: No. 1, 22-3(June 1962).

24351 CHARGE DISTRIBUTION IN NUCLEAR FISSION: STUDIES WITH ENERGY DEPOSIT OF ABOUT 22 Mev. Charles D. Coryell, Howard A. Storms, and Richard D. Fink (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 23-4(June 1962).

24352 ANALYSIS OF RADIATIONS FROM SPENT FUEL ELEMENTS USING A BENT-CRYSTAL SPECTROGRAPH. Norman C. Rasmussen and Morton D. Cohan (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 24(June 1962).

24353 MEASUREMENTS OF REACTOR PARAMETERS IN SUBCRITICAL AND CRITICAL ASSEMBLIES: A REVIEW. I. Kaplan (Massachusetts Institute of Tech.,

Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 25(June 1962).

24354 MEASUREMENTS OF REACTOR PARAMETERS IN SUBCRITICAL AND CRITICAL ASSEMBLIES—LATTICES OF SLIGHTLY ENRICHED URANIUM IN WATER. Glen A. Price (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 25-6(June 1962).

24355 MEASUREMENTS OF NATURAL-URANIUM, HEAVY-WATER LATTICES. J. L. Crandall (E. I. duPont de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 26-7(June 1962).

24356 MEASUREMENTS OF REACTOR PARAMETERS IN SUBCRITICAL AND CRITICAL ASSEMBLIES: MEASUREMENTS IN URANIUM-GRAPHITE LATTICES. R. E. Heineman (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 27-8(June 1962).

24357 MEASUREMENTS IN FAST ASSEMBLIES AT ARGONNE. R. Avery (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 28-9(June 1962).

24358 THE LOS ALAMOS FAST CRITICAL PROGRAM. Hugh C. Paxton (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nuclear Soc., 5: No. 1, 29-30 (June 1962).

24359 FLUX PERTURBATIONS—MEASUREMENTS. G. C. Hanna (Atomic Energy of Canada, Ltd., Chalk River). Trans. Am. Nuclear Soc., 5: No. 1, 30-1(June 1962).

24360 A DISCUSSION OF THEORETICAL ANALYSES OF PROBE-INDUCED THERMAL FLUX PERTURBATIONS. R. K. Osborn (Univ. of Michigan, Ann Arbor). Trans. Am. Nuclear Soc., 5: No. 1, 31-2(June 1962).

24361 EXPERIMENTAL DETERMINATION OF FLUX DEPRESSION AND OTHER CORRECTIONS FOR GOLD FOILS EXPOSED IN WATER. Walter Zobel (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 32(June 1962).

24362 VARIATIONAL MONTE CARLO CALCULATIONS OF FLUX DEPRESSION IN FOILS. F. R. Nakache, H. Goldstein, and M. H. Kalos (Columbia Univ., New York and United Nuclear Corp., White Plains, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 32-3(June 1962).

24363 PERTURBATION OF FOIL ACTIVATION IN THERMAL NEUTRON FIELDS. C. W. Tittle (Southern Methodist Univ., Dallas). Trans. Am. Nuclear Soc., 5: No. 1, 33(June 1962).

24364 FOIL-DATA THICKNESS CORRECTIONS AS AFFECTED BY SELF-SHIELDING AND FLUX DEPRESSION. George S. Stanford (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 33-4(June 1962).

24365 THE EFFECTS OF ANISOTROPY ON NEUTRON DETECTOR FLUX DEPRESSION. G. Ronald Dalton (Univ. of Florida, Gainesville). Trans. Am. Nuclear Soc., 5: No. 1, 34-5(June 1962).

24366 LOW ENERGY NEUTRON SPECTRA IN D_2O AND H_2O MODERATED MEDIA. J. C. Young, J. R. Beyster, D. H. Houston, Y. D. Naliboff, and G. D. Trimble (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 35-6(June 1962).

24367 TWO-DIMENSIONAL THERMAL SPECTRUM CALCULATIONS. J. W. Smiley and J. J. Bulmer (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 36-7(June 1962).

24368 A COMPARISON OF A SELF-ADJOINT VARIATIONAL METHOD TO 36-GROUP THERMAL SPECTRUM CALCULATIONS OF HETEROGENEOUS ARRAYS. S. L. Shufler (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 37-9(June 1962).

24369 MEASUREMENT OF NEUTRON ENERGY SPECTRA WITH THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY FAST CHOPPER. Carl A. Anderson, Jr. and Theos J. Thompson (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 39-40 (June 1962).

24370 SPATIALLY DEPENDENT SPECTRA AT ENERGIES ABOVE THERMAL. F. D. Federighi and P. A. Ombrellaro (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 40(June 1962).

24371 TRANSPORT CORRECTIONS TO DIFFUSION THEORY. D. S. Selengut (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 40-1(June 1962).

24372 GENERALIZED VARIATIONAL METHOD. M. D. Kostin and H. Brooks (Harvard Univ., Cambridge, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 41(June 1962).

24373 CALCULATIONAL MODELS OF DIFFUSION LENGTH EXPERIMENTS IN LIGHT WATER. B. A. Kerr and J. L. Russell, Jr. (General Electric Co., Pleasanton, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 41-2(June 1962).

24374 THE NEUTRON DIFFUSION COEFFICIENT IN D_2O BETWEEN 20°C AND 220°C. Norman P. Baumann (E. I. duPonte de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 42-3(June 1962).

24375 MEASUREMENT OF THE DIFFUSION PARAMETERS OF GRAPHITE AND GRAPHITE–BISMUTH BY PULSED NEUTRON METHODS. E. Starr and G. A. Price (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 43-4(June 1962).

24376 NEUTRON THERMALIZATION BY BOUND MODERATORS. K. D. Lathrop and H. Lurie (California Inst. of Tech., Pasadena). Trans. Am. Nuclear Soc., 5: No. 1, 44-6(June 1962).

24377 APPLICATION OF POLYNOMIAL METHOD IN THE STUDY OF THERMAL NEUTRON SPECTRUM IN A HEAVY CRYSTALLINE MEDIUM. S. N. Purohit (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 46-7(June 1962).

24378 A PHASE INTEGRAL STUDY OF THE HEAVY GAS MODEL. Noel Corngold (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 47 (June 1962).

24379 AN INCOHERENT THERMAL SCATTERING MODEL FOR HEAVY WATER. Henry C. Honeck (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 47-8(June 1962).

24380 SPECTRAL TEMPERATURE COEFFICIENTS IN ZIRCONIUM HYDRIDE MODERATED REACTORS. PART I. ANALYSIS OF EXPERIMENTS. R. L. Brehm, J. Miller, and W. J. Roberts (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 48-9(June 1962).

24381 SPECTRAL TEMPERATURE COEFFICIENTS IN ZIRCONIUM HYDRIDE MODERATED REACTORS. PART II. THEORY. J. Miller, W. J. Roberts, and R. L. Brehm (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 49-50(June 1962).

24382 U-235 FISSION-PRODUCT POISON EXPERIMENTS. S. B. Gunst, J. C. Connor, E. D. McGarry, D. E. Conway, and S. Stein (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 50-1(June 1962).

24383 LEAST SQUARES ADJUSTED VALUES OF THE 2200-m/sec CROSS SECTIONS OF U-233, U-235, and Pu-239. R. Sher and J. Felberbaum (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 51(June 1962).

24384 SENSITIVITY OF REACTIVITY LIFETIME TO FISSION-PRODUCT CROSS SECTIONS. Alfred M. Perry and Roger S. Carlsmith (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 51-2(June 1962).

24385 A CRITICAL EXAMINATION OF SOME UNCERTAINTIES IN PREDICTED GROSS FISSION-PRODUCT POISONING. E. C. Hansen (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 52-3(June 1962).

24386 CROSS SECTIONS FOR FISSILE ELEMENTS: A SIMPLE APPROACH TO THE MULTILEVER FORMALISM. D. Baroncini Adler and F. T. Adler (Univ. of Illinois, Urbana). Trans. Am. Nuclear Soc., 5: No. 1, 53-4 (June 1962).

24387 SCATTERING RESONANCES AND FAST REACTOR CALCULATIONS. G. L. Ball, R. D. Nicholson, and P. F. Zweifel (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nuclear Soc., 5: No. 1, 54 (June 1962).

24388 LOW ENERGY NEUTRONS FROM Be(α,n) SOURCES AND Be(n,2n) REACTIONS. Donald Bogart and Donald Shook (NASA Lewis Research Center, Cleveland). Trans. Am. Nuclear Soc., 5: No. 1, 54-5(June 1962).

24389 THERMAL NEUTRON CAPTURE CROSS SECTION AND RESONANCE CAPTURE INTEGRAL OF Ce-144. P. M. Lantz (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 55-6(June 1962).

24390 THEORY OF RESONANCE ABSORPTION OF NEUTRONS. II. Rubin Goldstein (Univ. of California, Berkeley) and E. Richard Cohen. Trans. Am. Nuclear Soc., 5: No. 1, 56-7(June 1962).

24391 ARES—A RESONANCE INTEGRAL CODE. F. L. Fillmore (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 57(June 1962).

24392 DIRECT METHOD FOR CALCULATING THE SPATIAL DISTRIBUTION OF RESONANCE ABSORPTIONS. Harvey J. Amster (Univ. of California, Berkeley). Trans. Am. Nuclear Soc., 5: No. 1, 57-8(June 1962).

24393 ACCURATE COMPUTATION OF DOPPLER BROADENING. G. W. Hinman, G. F. Kuncir, and J. B. Sampson (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 58-9(June 1962).

24394 RESONANCE ABSORPTION IN MATERIALS WITH GRAIN STRUCTURE. R. K. Lane, L. W. Nordheim, and J. B. Sampson (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 59(June 1962).

24395 THE EFFECTIVE U-238 RESONANCE CAPTURE INTEGRAL OF URANIUM METAL AND UO_2. G. G. Smith, J. Hardy, Jr., and D. Klein (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 59-60(June 1962).

24396 , HIGH ENERGY RESONANCE INTEGRAL. Melvin M. Levine (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 60-1(June 1962).

24397 THE INFLUENCE OF CORE SHAPE ON FAST REACTOR CRITICALITY. W. B. Loewenstein and G. W. Main (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 61-2(June 1962).

24398 FISSION NEUTRON IMPORTANCE IN A FAST REACTOR SPECTRUM. J. B. Nims and C. S. Yeh (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nuclear Soc., 5: No. 1, 62(June 1962).

24399 AN ANALYTIC APPROACH TO TWO-DIMENSIONAL REACTOR THEORY. H. L. Garabedian and D. H. Thomas (General Motors Research Lab., Warren, Mich.). Trans. Am. Nuclear Soc., 5: No. 1, 63(June 1962).

24400 A VARIATIONAL PROCEDURE FOR CALCULATING FAST GROUP DIFFUSION THEORY PARAMETERS. P. A. Ombrellaro and F. D. Federighi (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 63-4(June 1962).

24401 REFINEMENTS IN TWO-GROUP CALCULATIONS. H. K. Clark (E. I. duPont de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 64-5 (June 1962).

24402 CONVERGENCE RATES OF DISADVANTAGE FACTORS FOR SLAB GEOMETRY. J. O. Mingle (Kansas State Univ., Manhattan). Trans. Am. Nuclear Soc., 5: No. 1, 65(June 1962).

24403 SETTING THE NEUTRON CURRENT AT THE BOUNDARIES WHEN USING A DIFFUSION CODE. N. R. Williamsen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 65-6(June 1962).

24404 A SIMPLE METHOD FOR THE CALCULATION OF THE CONTROL ROD DIFFERENTIAL WORTH. Angelo Camplani (Societa Elettronucleare Italiana, Milan). Trans. Am. Nuclear Soc., 5: No. 1, 66-7(June 1962).

24405 LOCALIZED SOURCE MULTIPLICATION AND REACTOR STARTUP. R. E. Mueller, R. B. Nicholson, and P. F. Zweifel (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nuclear Soc., 5: No. 1, 67(June 1962).

24406 CRITICAL MASS CALCULATIONS OF A MULTISPECTRUM CRITICAL ASSEMBLY. L. A. Mountford and V. E. Kistler (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 68 (June 1962).

24407 REACTIVITY MEASUREMENTS IN THE AETR CRITICAL ASSEMBLY. S. G. Carpenter and V. E. Kistler (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 68-9(June 1962).

24408 ANALYSIS OF FIRST AETR CRITICAL ASSEMBLY CONTAINING A THORIUM CARBIDE–URANIUM-233 TEST CORE MOCKUP. A. V. Campise (Atomic Interna-

tional, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 69-70(June 1962).

24409 DESCRIPTION AND ANALYSIS OF FURTHER CRITICAL EXPERIMENTS WITH DOUBLE ANNULAR FUEL ELEMENTS IN SUPERHEATER GEOMETRIES. P. G. Klann, C. O. Dechand, E. Fein, and M. F. Gormley (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nuclear Soc., 5: No. 1, 70(June 1962).

24410 CRITICAL STUDIES WITH ZPR-III FOR THE ENRICO FERMI FAST REACTOR CORE B. Thomas A. Doyle (Atomic Power Development Associates, Inc., Detroit) and Allen L. Hess. Trans. Am. Nuclear Soc., 5: No. 1, 71(June 1962).

24411 EXPERIMENTS AND ANALYSIS OF BERYLLIUM OXIDE MODERATED CORES CONTAINING HYDROGEN. PART I. EXPERIMENTS. W. B. Wright and A. J. Goodjohn (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 71-2(June 1962).

24412 EXPERIMENTS AND ANALYSIS OF BERYLLIUM OXIDE MODERATED CORES CONTAINING HYDROGEN. PART II. ANALYSIS. W. B. Wright and A. J. Goodjohn (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 72-3(June 1962).

24413 CRITICAL EXPERIMENTS PERFORMED ON VERY SMALL DIAMETER PRESSURIZED WATER REACTOR CORE MOCKUPS. A. J. Svasek, S. N. Kemp, L. D. Walthousen, and W. J. McCool (Alco Products, Inc., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 73-4 (June 1962).

24414 MEASUREMENTS OF BUCKLINGS AND VOID EFFECTS IN D_2O MODERATED LATTICES OF UO_2 ROD CLUSTERS. W. E. Graves and G. F. O'Neill (E. I. duPont de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 74(June 1962).

24415 EFFECTS OF REFLECTORS AND VOIDS ON EXPONENTIAL MEASUREMENTS IN D_2O NATURAL URANIUM LATTICES. W. B. Rogers, Jr. (E. I. duPont de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 74-5(June 1962).

24416 CRITICAL MASS EXPERIMENTS WITH PLUTONIUM NITRATE SOLUTIONS. E. D. Clayton, R. C. Lloyd, and W. A. Reardon (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 75-6(June 1962).

24417 OPERATING EXPERIENCE IN THE HANFORD PLUTONIUM CRITICAL MASS FACILITY. R. C. Lloyd, E. D. Clayton, and W. A. Reardon (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 76-7(June 1962).

24418 MEASUREMENT OF NEUTRON IMPORTANCE IN MIXED-SPECTRA CRITICAL ASSEMBLIES. R. J. Tuttle and S. G. Carpenter (Atomic International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 77-8 (June 1962).

24419 SUBCRITICAL EXPERIMENT WITH URANIUM CARBIDE FUEL FOR THE HALLAM NUCLEAR POWER FACILITY REACTOR. O. R. Hillig (Atomics International, Canoga Park, Calif.) and T. L. Guzzle. Trans. Am. Nuclear Soc., 5: No. 1, 78(June 1962).

24420 EXPERIMENTS INVOLVING GAPS IN CRITICAL ASSEMBLIES. Arthur G. Cole (Univ. of California, Livermore). Trans. Am. Nuclear Soc., 5: No. 1, 79-80 (June 1962).

24421 EXPERIMENTS WITH NICKEL AS A REACTOR REFLECTOR MATERIAL. Arthur G. Cole (Univ. of California, Livermore). Trans. Am. Nuclear Soc., 5: No. 1, 80(June 1962).

24422 USE OF GADOLINIUM SEPTA IN SLAB CORES. J. J. Kepes and J. A. Mitchell (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 81-2(June 1962).

24423 PROMPT NEUTRON DECAY CONSTANTS FOR DELAYED CRITICAL IN THE HIGH FLUX ISOTOPE REACTOR CRITICAL EXPERIMENT. Dale W. Magnuson (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 82(June 1962).

24424 THE INVESTIGATION OF SUBCRITICAL FAST REACTOR ASSEMBLIES BY THE NANOSECOND PULSED NEUTRON SOURCE TECHNIQUE. L. E. Beghian, N. C. Rasmussen, R. Thews, and J. Weber (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 82-3(June 1962).

24425 THERMAL UTILIZATION—THE IMPORTANCE OF SPATIALLY DEPENDENT SPECTRA. G. T. Petersen and H. F. Johnston (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 83(June 1962).

24426 MICROSCOPIC PARAMETERS BY THE CADMIUM RATIO TECHNIQUE AND PERTURBATION EFFECTS. H. A. Risti (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 84-5(June 1962).

24427 k_∞ MEASUREMENTS OF NATURAL UO_2, HEAVY WATER MODERATED LATTICES IN THE PAWLING LATTICE TEST RIG. R. D. Schamberger, G. G. Foster, and W. L. Brooks (United Nuclear Corp., White Plains, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 85 (June 1962).

24428 CALCULATION OF THE FLUX DISTRIBUTION IN A CAVITY ASSEMBLY. J. T. Madell, T. J. Thompson, I. Kaplan, and A. E. Profio (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 85-6(June 1962).

24429 MEASUREMENTS OF U-238 CAPTURE AND FAST FISSION IN NATURAL URANIUM, HEAVY WATER LATTICES. A. Weitzberg, J. R. Wolberg, T. J. Thompson, A. E. Profio, and I. Kaplan (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 86-7(June 1962).

24430 MEASUREMENTS OF MICROSCOPIC AND MACROSCOPIC FLUX DISTRIBUTIONS IN NATURAL URANIUM, HEAVY-WATER LATTICES. P. S. Brown, P. F. Palmedo, T. J. Thompson, A. E. Profio, and I. Kaplan (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 87-8(June 1962).

24431 MANGANESE BATH MEASUREMENTS OF η OF Pu-239. W. S. Lyon, R. L. Macklin, G. DeSaussure, and J. D. Kington (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 88(June 1962).

24432 CALCULATIONS OF NEUTRON LEAKAGE AND HIGH ENERGY ABSORPTIONS IN A MANGANESE SULFATE BATH. Herbert Goldstein (Columbia Univ., New York and United Nuclear Corp., White Plains, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 89(June 1962).

24433 EFFECT OF RESONANCE SCATTERING ON THE COBALT ABSORPTION INTEGRAL. Simon Kellman and Eugene Goldberg (Univ. of California, Livermore). Trans. Am. Nuclear Soc., 5: No. 1, 89-90(June 1962).

24434 THE DETERMINATION OF k_∞ FOR THREE PERCENT U-235 ENRICHED UO_2 AND SLIGHTLY ENRICHED URANIUM METAL FROM MONTE CARLO CALCULATIONS. C. R. Richey (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 90-1 (June 1962).

24435 FUEL ASSEMBLY DESIGN PROGRAM, FAD. J. C. Jensen (E. I. duPont de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 91-2(June 1962).

24436 ULCER AND QUICKIE, MULTIGROUP DIFFUSION THEORY PROGRAMS FOR THERMALIZATION STUDIES. W. A. Rhoades and D. Vargofcak (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 92(June 1962).

24437 CYCLE AND COST, CODES FOR FAST REACTOR FUEL CYCLE ANALYSIS AND RELATED COST EVALUATION. B. J. Toppel, R. Avery, and G. J. Fischer (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 92-3(June 1962).

24438 CONEC—A NEW COUPLED NEUTRONICS-ELASTICITY THEORY CODE. N. Pruvost and O. C. Kolar (Univ. of California, Livermore). Trans. Am. Nuclear Soc., 5: No. 1, 93-4(June 1962).

24439 DOPPLER BROADENED RESONANCE ABSORPTION IN HETEROGENEOUS SYSTEMS CONTAINING SEVERAL RESONANCE MATERIALS FOR A NUMBER OF SLAB AND PARTICLE GEOMETRIES IN WATER. R. C. Gast and N. R. Candelore (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 94-5(June 1962).

24440 GATHER-II, A CONSISTENT B_1 CODE FOR THE CALCULATION OF THERMAL NEUTRON SPECTRA AND ASSOCIATED MULTIGROUP CONSTANTS. G. D. Joanou and P. C. Kaestner (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 95(June 1962).

24441 A TWO-DIMENSIONAL PERTURBATION CODE AND ITS APPLICATION TO REACTIVITY COEFFICIENTS IN THE EXPERIMENTAL BREEDER REACTOR II. J. M. Chaumount (Argonne National Lab., Idaho Falls, Idaho) and J. A. Koerner. Trans. Am. Nuclear Soc., 5: No. 1, 95-6 (June 1962).

24442 COMPUTATION SCHEMES FOR REACTOR THERMAL TRANSIENTS. Garrett Birkhoff (Harvard Univ., Cambridge, Mass.) and T. F. Kimes. Trans. Am. Nuclear Soc., 5: No. 1, 97(June 1962).

24443 THE COMPUTATIONAL PROBLEMS OF PLASMA PHYSICS. R. van Norton (New York Univ., New York). Trans. Am. Nuclear Soc., 5: No. 1, 97-8 (June 1962).

24444 BASIC CONCEPTS FOR A STEADY-STATE FUSION REACTOR. D. J. Rose (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 98(June 1962).

24445 STATUS OF THE DCX-2 PROGRAM. Robert J. Mackin, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 99(June 1962).

24446 INJECTION INTO FUSION MACHINES USING THE LORENTZ FORCE. John R. Hiskes (Univ. of California, Livermore). Trans. Am. Nuclear Soc., 5: No. 1, 99-100(June 1962).

24447 MATERIALS AND ENERGY RECOVERY IN PROPOSED FUSION POWER REACTORS. W. G. Homeyer and A. J. Impink, Jr. (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 100 (June 1962).

24448 TRITIUM REGENERATION IN PROPOSED FUSION POWER REACTORS. A. J. Impink, Jr. and W. G. Homeyer (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 100-1(June 1962).

24449 ORGANIC-COOLED NUCLEAR REACTORS—A REVIEW. Edward A. Mason (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 101-3(June 1962).

24450 ORGEL: A EUROPEAN POWER REACTOR DESIGN. J. C. Leny (EURATOM, Brussels). Trans. Am. Nuclear Soc., 5: No. 1, 103-4(June 1962).

24451 ESSOR: SPECIFIC TEST REACTOR FOR ORGEL PROGRAM. J. C. Leny (EURATOM, Brussels). Trans. Am. Nuclear Soc., 5: No. 1, 104(June 1962).

24452 CANADA'S ORGANIC COOLED REACTOR PROGRAM. W. M. Campbell (Atomic Energy of Canada, Ltd., Chalk River). Trans. Am. Nuclear Soc., 5: No. 1, 104-5(June 1962).

24453 ECONOMIC ANALYSIS OF ORGANIC-COOLED HEAVY-WATER-MODERATED NATURAL-URANIUM REACTORS. G. A. Pon and D. B. Primeau (Atomic Energy of Canada, Ltd., Chalk River). Trans. Am. Nuclear Soc., 5: No. 1, 105-6(June 1962).

24454 PROGRESS ON THE ITALIAN ORGANIC REACTOR PROGRAM. Alberto Pedretti and Raffaele Di Meana (Comitato Nazionale per l'Energie Nucleare, Rome). Trans. Am. Nuclear Soc., 5: No. 1, 106(June 1962).

24455 IN-PILE IRRADIATION OF SANTOWAX OMP. E. A. Mason, D. T. Morgan, W. N. Bley, T. W. Carroll, J. P. Casey, E. Sefchovich, and A. Turricchia (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 106-7(June 1962).

24456 HEAT TRANSFER CHARACTERISTICS OF IRRADIATED SANTOWAX OMP. E. A. Mason, D. T. Morgan, W. N. Bley, T. J. Swierzawski, and J. P. Casey (Massachusetts Institute of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 107-8(June 1962).

24457 COOLANT DECOMPOSITION RATES AND MAKEUP COSTS FOR ORGANIC REACTORS. R. H. J. Gercke and J. F. Zack, Jr. (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 108-10 (June 1962).

24458 AN IRRADIATION OF HIGHLY RATED SAP-CLAD UO_2 FUEL SPECIMENS IN ORGANIC COOLANT. R. F. S. Robertson, H. E. Thexton, and D. E. Low (Atomic Energy of Canada, Ltd., Chalk River). Trans. Am. Nuclear Soc., 5: No. 1, 110(June 1962).

24459 FOULING OF HEAT TRANSFER SURFACES BY ORGANIC COOLANTS. A. M. Aikin and D. H. Charlesworth (Atomic Energy of Canada, Ltd., Chalk River). Trans. Am. Nuclear Soc., 5: No. 1, 110-11(June 1962).

24460 AN OUT-OF-PILE ELECTRON IRRADIATION CIRCULATING LOOP FOR FOULING STUDIES. R. A.

Hoegelkamp, P. S. Hudson, and J. C. Hillyer (Phillips Petroleum Co., Bartlesville, Okla.). Trans. Am. Nuclear Soc., 5: No. 1, 111-12(June 1962).

24461 PHYSICAL AND THERMODYNAMIC PROPERTIES OF BIPHENYL. M. V. Milnes and J. A. Ellard (Monsanto Research Corp., Dayton, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 112(June 1962).

24462 RECLAMATION OF ORGANIC NUCLEAR REACTOR COOLANT. R. J. Wineman, D. A. Scola, and J. N. Adams (Monsanto Research Corp., Boston). Trans. Am. Nuclear Soc., 5: No. 1, 112-13(June 1962).

24463 DEVELOPMENT OF APM-CLAD UO_2 FUEL ELEMENTS. S. O. Arneson (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 113-14(June 1962).

24464 DEVELOPMENT OF FUEL AND CLADDING MATERIALS FOR THE ORGEL PROJECT. C. Moranville (EURATOM, Brussels). Trans. Am. Nuclear Soc., 5: No. 1, 114(June 1962).

24465 PIQUA CORE PROCESS DEVELOPMENT AND FABRICATION. C. T. Armenoff (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 115(June 1962).

24466 YANKEE SUMMARY AND EVALUATION. W. Webster (Yankee Atomic Electric Co., Boston). Trans. Am. Nuclear Soc., 5: No. 1, 116(June 1962).

24467 YANKEE PLANT AND REACTOR PERFORMANCE. R. J. Coe, W. J. Miller, L. E. Minnick, and G. A. Reed (Yankee Atomic Electric Co., Boston). Trans. Am. Nuclear Soc., 5: No. 1, 116-17(June 1962).

24468 YANKEE FUEL CYCLE DEVELOPMENT. J. E. Tribble (Yankee Atomic Electric Co., Boston) and J. D. McGaugh. Trans. Am. Nuclear Soc., 5: No. 1, 117-18 (June 1962).

24469 CONTROL ROD WORTH MEASUREMENTS IN THE YANKEE ATOMIC ELECTRIC REACTOR. J. E. Howard (Yankee Atomic Electric Co., Boston) and D. Hunter. Trans. Am. Nuclear Soc., 5: No. 1, 118-19 (June 1962).

24470 RESULTS OBTAINED FROM THE IN-CORE INSTRUMENTATION IN YANKEE CORE I. J. E. Howard (Yankee Atomic Electric Co., Boston) and D. Hunter. Trans. Am. Nuclear Soc., 5: No. 1, 119-20(June 1962).

24471 REACTIVITY CALCULATIONS IN YANKEE CORE I. C. G. Poncelet, J. D. McGaugh, and H. W. Graves, Jr. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 120-1(June 1962).

24472 REACTIVITY BEHAVIOR OF YANKEE CORE I. H. W. Graves, Jr. (Westinghouse Electric Corp., Pittsburgh), J. E. Howard, and T. J. Thompson. Trans. Am. Nuclear Soc., 5: No. 1, 121(June 1962).

24473 THE CONCEPTUAL DESIGN OF THE MIXED SPECTRUM SUPERHEATER. B. Wolfe, G. Brynsvold, K. Ikkido, D. Riley, and A. Silvester (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 122-3(June 1962).

24474 PHYSICS ANALYSIS OF THE MIXED SPECTRUM SUPERHEATER. A. B. Reynolds and B. Wolfe (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 123(June 1962).

24475 A SUPERHEAT CYCLE FOR LIGHT-WATER-MODERATED AND -COOLED REACTORS. P. C. Zmola and D. G. Sanders (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nuclear Soc., 5: No. 1, 123-4(June 1962).

24476 STATUS AND POTENTIAL OF SMALL POWER REACTORS. R. W. Ritzmann (U. S. Atomic Energy Commission, Washington, D. C.). Trans. Am. Nuclear Soc., 5: No. 1, 124-5(June 1962).

24477 STATUS AND POTENTIAL OF FULLY ENRICHED UO_2 STAINLESS DISPERSION FLAT PLATE REACTOR CORES. Joseph G. Gallagher (Alco Products, Inc., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 125-6(June 1962).

24478 EVALUATION OF FAST U-233-Th BREEDER REACTORS. R. D. Hankel and Leon Joseph (United Nuclear Corp., White Plains, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 126(June 1962).

24479 CORE DESIGN STUDY FOR A 500-Mwe FAST OXIDE REACTOR. K. M. Horst, B. A. Hutchins, F. B. Leitz, and B. Wolfe (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 126-7(June 1962).

24480 COMPARATIVE STUDY OF PLUTONIUM–URANIUM CARBIDE AND PLUTONIUM–URANIUM OXIDE FUEL IN A SODIUM COOLED FAST REACTOR. K. M. Horst and B. A. Hutchins (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 127(June 1962).

24481 STATUS OF THE SETTLED BED FAST REACTOR. William A. Robba (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 127-8(June 1962).

24482 STUDY OF REACTOR GRAPHITE COMBUSTION. R. E. Dahl (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 128(June 1962).

24483 A STUDY OF THE FUEL VALUES OF Pu AND U-233. Paul R. Kasten and Leonard L. Bennet (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 129(June 1962).

24484 FUEL CYCLE STUDIES FOR FAST POWER BREEDER REACTORS. G. J. Fischer, R. Avery, and B. J. Toppel (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 130-1(June 1962).

24485 ECONOMIC EVALUATION OF CONTROL RODS FOR LIGHT WATER REACTORS. H. E. Williamson and F. H. Megerth (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 131-2(June 1962).

24486 ABSORBER BURN-UP EXPERIMENT. J. L. Russell, Jr. and M. R. Carrothers (General Electric Co., Pleasanton, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 132-3(June 1962).

24487 DESIGN STUDIES ON THE SELECTION OF THE CONTROL METHOD AND REFLECTOR MATERIALS FOR THE ADVANCED TEST REACTOR. R. N. Moore (Babcock and Wilcox Co., Lynchburg, Va.) and A. W. Flynn. Trans. Am. Nuclear Soc., 5: No. 1, 133(June 1962).

24488 MECHANICAL DESIGN OF THE ADVANCED TEST REACTOR. G. R. Winders (Babcock and Wilcox Co., Lynchburg, Va.). Trans. Am. Nuclear Soc., 5: No. 1, 133-4(June 1962).

24489 CONTAINMENT VESSEL STUDIES FOR HIGH TEMPERATURE GAS-COOLED REACTORS. David Rose (General Atomic Div., General Dynamics Corp., San Diego, Calif.), W. A. Chittenden, and R. N. Bergstrom. Trans. Am. Nuclear Soc., 5: No. 1, 134-5(June 1962).

24490 FAILURE OF SPERT III PRESSURIZER VESSEL. R. E. Heffner (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 135(June 1962).

24491 OPERATING COSTS OF THE MIT REACTOR. L. Clark, Jr. and T. J. Thompson (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 135-6(June 1962).

24492 NUCLEAR BEHAVIOR OF THE SHIPPINGPORT REACTOR THROUGH THREE SEEDS. J. H. Leonard (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 136-7(June 1962).

24493 EVALUATION OF ISOTOPIC COMPOSITION OF IRRADIATED UO_2 FUEL RODS FROM SHIPPINGPORT. C. D. Sphar (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 137(June 1962).

24494 STARTUP NUCLEAR TESTING OF A PORTABLE NUCLEAR POWER STATION AT A REMOTE ARCTIC SITE. Whittie J. McCool and E. W. Schrader (Alco Products, Inc., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 137-8(June 1962).

24495 PHOTONEUTRON SOURCE IN URANIUM–WATER REACTORS AFTER POWER OPERATION. D. R. Harris (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 138-9(June 1962).

24496 A SINGLE-SOLUTION CHEMICAL DECONTAMINATION TREATMENT FOR NUCLEAR REACTORS. N. Michael (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 139(June 1962).

24497 IN-PILE LOOP FOR THE HIGH-TEMPERATURE GAS-COOLED, GRAPHITE-MODERATED POWER REACTOR. Robert H. Simon (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 139-40(June 1962).

24498 CONSERVATION OF HELIUM BY MEANS OF RADIOACTIVE ARGON MEASUREMENTS. Sterling L. Nelson (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 140-1(June 1962).

24499 HEAVY WATER REACTOR PLANT LEAKAGE. W. A. Chittenden and G. F. Hoveke (Sargent and Lundy, Chicago). Trans. Am. Nuclear Soc., 5: No. 1, 141-2(June 1962).

24500 HEAT CONDUCTION IN A ONE DIMENSIONAL GEOMETRY WITH NONUNIFORM INTERNAL HEAT GENERATION. Gilbert B. Melese and J. Ernest Wilkins, Jr. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 142-3(June 1962).

24501 SIMPLIFIED METHODS OF PREDICTING TEMPERATURE TRANSIENTS IN A FAST REACTOR EXCURSION. Arthur J. Goldman and Ralph P. Stein (United Nuclear Corp., White Plains, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 143-4(June 1962).

24502 FUEL-CLADDING GAP EFFECTS ON ANNULAR FUEL ELEMENT HEAT TRANSFER. M. F. Lyons (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 144(June 1962).

24503 BEHAVIOR OF A STEAM-PRESSURIZER SURGE TANK. Eugene E. Drucker and Kin Nee Tong (Syracuse Univ., N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 144-5(June 1962).

24504 LOCAL FILM COEFFICIENTS ON THE ML-1 FUEL ELEMENTS DUE TO BOUNDARY LAYER TURBULENCE PROMOTERS. N. Kattchee and W. V. Mackewicz (Aerojet-General Nucleonics, San Ramon, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 145-6(June 1962).

24505 AN ANALYSIS OF FUEL ELEMENT SURFACE TEMPERATURE AND COOLANT FLOW RATE IN THE UNIVERSITY OF VIRGINIA REACTOR. W. K. Brunot and J. L. Meem (Univ. of Virginia, Charlottesville). Trans. Am. Nuclear Soc., 5: No. 1, 146-7(June 1962).

24506 FLOW AND STABILITY PROBLEMS IN MULTIPLE-CHANNEL NATURAL CONVECTION SYSTEMS. John C. Chato (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 147-8 (June 1962).

24507 SIGNIFICANT PARAMETERS IN DNB. L. S. Tong, H. B. Currin, and A. G. Thorp, II (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 148-9(June 1962).

24508 APPLICATION OF STEAM ENERGY FLOW TO REACTOR DESIGN. William J. Levedahl (General Nuclear Engineering Corp., Dunedin, Fla.). Trans. Am. Nuclear Soc., 5: No. 1, 149-50(June 1962).

24509 DETERMINATION OF THE BOUNDARY OF THE LOCAL BOILING REGION IN PRESSURIZED WATER REACTOR CORES. H. Chelemer (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 150-1(June 1962).

24510 THE VELOCITY OF RISING STEAM IN A BUBBLING TWO-PHASE MIXTURE. John F. Wilson, Ronald J. Grenda, and John F. Patterson (Allis-Chalmers Mfg. Co., Milwaukee). Trans. Am. Nuclear Soc., 5: No. 1, 151-2(June 1962).

24511 SL-1 RECOVERY OPERATION. C. L. Storrs (General Electric Co., Idaho Falls, Idaho) and C. W. Bills. Trans. Am. Nuclear Soc., 5: No. 1, 152(June 1962).

24512 EXAMINATION OF THE SL-1 CORE AND PRESSURE VESSEL IN THE HOT SHOP. L. C. Faupell (General Electric Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 152-3(June 1962).

24513 OBSERVATIONS OF SL-1 INCIDENT EFFECTS. G. G. Plastino, F. L. Sims, T. A. Linn, and D. C. Durrill (General Electric Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 153-4(June 1962).

24514 CORRELATION OF NUCLEAR AND MECHANICAL EFFECTS IN THE SL-1 INCIDENT. J. F. Kunze (General Electric Co., Idaho Falls, Idaho) and C. W. Bills. Trans. Am. Nuclear Soc., 5: No. 1, 154-5(June 1962).

24515 SHUTDOWN MECHANISMS AND REACTOR SAFETY. W. E. Nyer (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 155-6 (June 1962).

24516 POWER LIMITING AND SHUTDOWN MECHANISMS IN A HEAVY WATER REACTOR. C. E. Bailey (E. I. du Pont de Nemours and Co., Aiken, S. C.). Trans. Am. Nuclear Soc., 5: No. 1, 156-7(June 1962).

24517 DIRECT MEASUREMENT OF THE DYNAMIC DOPPLER COEFFICIENT BY SELF-LIMITING POWER EXCURSION TESTS. A. H. Spano (Phillips Petroleum Co., Idaho Falls, Idaho) and W. K. Ergen. Trans. Am. Nuclear Soc., 5: No. 1, 157-8(June 1962).

24518 EXCURSION SHUTDOWN MECHANISM FOR LARGE FAST OXIDE REACTORS. Paul Greebler and

D. B. Sherer (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 158-9(June 1962).

24519 REACTOR SHUTDOWN MECHANISMS IN THE PEACH BOTTOM HIGH TEMPERATURE GAS COOLED REACTOR. P. U. Fischer, M. H. Merrill, and N. F. Wikner (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 159(June 1962).

24520 THE TRIGA SHUTDOWN MECHANISM. G. R. Hopkins, M. S. Nelkin, R. Scalettar, and G. B. West (General Dynamics Corp., San Diego, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 159-60(June 1962).

24521 THE EFFECTS OF SYSTEM PRESSURE ON AMBIENT TEMPERATURE POWER EXCURSION TESTS IN A D_2O-MODERATED REACTOR. R. L. Johnson and J. E. Grund (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nuclear Soc., 5: No. 1, 160-1(June 1962).

24522 GAS MICROBUBBLE DILATION—A REACTOR SHUTDOWN MECHANISM. S. M. Zivi (Space Technology Labs., Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 161-2(June 1962).

24523 A REVIEW OF NONLINEAR REACTOR DYNAMICS PROBLEMS. J. Chernick (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 162(June 1962).

24524 XENON- AND TEMPERATURE-INDUCED INSTABILITIES IN A REFLECTED SLAB REACTOR. Louis Shotkin and Frederick H. Abernathy (Harvard Univ., Cambridge, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 162-3(June 1962).

24525 CONTROL OF SPATIAL XENON OSCILLATIONS. Gerald S. Lellouche (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 163-4 (June 1962).

24526 LIAPOUNOFF'S FUNCTIONS IN REACTOR DYNAMICS. Henri B. Smets (European Nuclear Energy Agency, Paris, France). Trans. Am. Nuclear Soc., 5: No. 1, 164-5(June 1962).

24527 HIGH-POWER REACTOR DESCRIBING FUNCTION. Arthur A. Wasserman (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 165-6(June 1962).

24528 EXPANSION FEEDBACK IN FAST PULSED REACTORS. Harry Soodak (City Coll., New York). Trans. Am. Nuclear Soc., 5: No. 1, 166(June 1962).

24529 ANALYSIS OF POWER RAMP MEASUREMENTS WITH AN ANALOG COMPUTER. R. W. Keaten and W. J. Carlson (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 166-7(June 1962).

24530 STARTUP TRANSIENTS IN BOILING WATER REACTORS. K. Almenas, N. Suda, and N. Ito (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 167-8(June 1962).

24531 CONTROL OF A BOILING WATER REACTOR WITH INTERNAL NUCLEAR SUPERHEATER. J. T. Stone and D. H. Crimmins (Allis-Chalmers Mfg. Co., Milwaukee). Trans. Am. Nuclear Soc., 5: No. 1, 168(June 1962).

24532 REACTIVITY CONTROL AND TRANSIENTS OF SELF-PRESSURIZED WATER REACTORS. R. J. Rickert, R. J. Sanderson, W. S. Flinn, and P. C. Zmola (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nuclear Soc., 5: No. 1, 168-70(June 1962).

24533 PRODUCTION OF VOID AND PRESSURE BY FISSION TRACK NUCLEATION OF RADIOLYTIC GAS BUBBLES DURING POWER BURSTS IN A SOLUTION REACTOR. P. Spiegler, C. F. Bumpus, Jr., and A. Norman (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 170(June 1962).

24534 LARGE AMPLITUDE STEAM VOID OSCILLATIONS UNDER FORCED FLOW. Robert W. Wright (Space Technology Labs., Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 170-2(June 1962).

24535 EFFECT OF FUEL-ROD BOWING DURING SELF-LIMITING POWER EXCURSIONS IN THE SPERT-1 OXIDE CORE. W. K. Ergen (Oak Ridge National Lab., Tenn.) and A. H. Spano. Trans. Am. Nuclear Soc., 5: No. 1, 172(June 1962).

24536 FUEL ROD BOWING IN THE SRE. H. F. Donohue and R. W. Keaten (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 172 (June 1962).

24537 NUCLEAR CONTROL CHARACTERISTICS OF THE PLUTONIUM RECYCLE TEST REACTOR. R. E. Peterson and V. W. Gustafson (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 173-4 (June 1962).

24538 REACTOR POWER SPECTRUM MEASUREMENTS. C. W. Griffin and R. L. Randall (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 174-5(June 1962).

24539 USE OF NOISE ANALYSIS TO MEASURE REACTOR STABILITY ON N. S. SAVANNAH. M. L. Batch and R. M. Ball (Babcock and Wilcox Co., Alliance, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 175(June 1962).

24540 SUPER-PROMPT CRITICAL BEHAVIOR OF AN UNREFLECTED, UNMODERATED URANIUM–MOLYBDENUM ALLOY ASSEMBLY. J. T. Mihalczo (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 175-6(June 1962).

24541 COLLOREK—AN EXPERIMENTAL CODE FOR REACTOR KINETICS CALCULATIONS. H. P. Flatt (International Business Machines Corp., Los Angeles). Trans. Am. Nuclear Soc., 5: No. 1, 176-7(June 1962).

24542 MEASUREMENT OF DYNAMIC TEMPERATURE COEFFICIENTS BY FORCED OSCILLATIONS IN COOLANT FLOW. R. W. Keaten (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 177 (June 1962).

24543 SYNTHESIS APPROXIMATIONS IN THE TIME DIRECTION. J. A. Bewick, A. F. Henry, and S. Kaplan (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 177-8(June 1962).

24544 CALCULATION OF COMPLEX NATURAL MODES FOR SPATIAL XENON OSCILLATIONS AND COMPARISON WITH A SIMPLE APPROXIMATION. R. L. Ewen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 179(June 1962).

24545 SCHEDULING COMPUTER SYSTEM FOR THE BIG ROCK PLANT. E. S. Beckjord and L. K. Holland (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 180(June 1962).

24546 A REACTIVITY MONITOR FOR REACTOR STARTUP. J. L. Shapiro (California Inst. of Tech., Pasadena). Trans. Am. Nuclear Soc., 5: No. 1, 180-1 (June 1962).

24547 EFFECTS OF SPACE RADIATION ON AUTOMATIC STARTUP OF ORBITING REACTORS. W. R. Butler and D. I. Gilbert (Aerojet-General Nucleonics, San Ramon, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 181-2(June 1962).

24548 A GRAPHICAL CONTROL PROGRAMMING METHOD FOR THE ADVANCED TEST REACTOR. A. E. Paulson (Babcock and Wilcox Co., Lynchburg, Va.). Trans. Am. Nuclear Soc., 5: No. 1, 182-3(June 1962).

24549 LOW-FREQUENCY WAVE ANALYZER FOR THE MEASUREMENT OF SPECTRAL DENSITY OF REACTOR POWER FLUCTUATIONS. M. N. Alam, A. L. Colomb, and K. M. Henry (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 183(June 1962).

24550 SIGNAL DETECTING APPARATUS FOR PILE OSCILLATOR EXPERIMENTS. Hugh F. Johnston (General Electric Co., Pleasanton, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 184(June 1962).

24551 NOISE MEASUREMENTS ON A REACTOR SERVO-CONTROL SYSTEM. E. F. Bennett and R. L. Long (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 184(June 1962).

24552 A MINIATURIZED FISSION CHAMBER AND PREAMPLIFIER ASSEMBLY FOR HIGH-FLUX REACTORS. D. P. Roux, E. Fairstein, G. C. Guerrant, S. H. Hanauer, and J. L. Kaufman (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 185(June 1962).

24553 SOLID-STATE FISSION COUNTERS USED WITH AETR CRITICAL ASSEMBLIES. D. Strominger (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 186(June 1962).

24554 SENSITIVITY OF PRESSURE TRANSDUCERS TO TRANSIENT NEUTRON AND GAMMA RADIATION. J. F. Boland, R. D. DeForest, R. O. Ivins, F. S. Kirn, H. Lawroski, and R. Liimatainen (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 186(June 1962).

24555 USE OF A HIGH-LEVEL GAMMA SPECTROMETER SYSTEM FOR NONDESTRUCTIVE INSPECTION. J. S. Eldridge and R. E. McDonald (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 187-8 (June 1962).

24556 BIOLOGICAL AND MEDICAL EFFECTS OF RADIATION. Shields Warren (New England Deaconess Hospital, Boston). Trans. Am. Nuclear Soc., 5: No. 1, Trans. Am. Nuclear Soc., 5: No. 1, 188-9(June 1962).

24557 SURVEY OF INTERACTIONS OF IONIZING RADIATIONS WITH BIOLOGICAL SUBSYSTEMS. David L. Joftes (New England Deaconess Hospital, Boston). Trans. Am. Nuclear Soc., 5: No. 1, 189(June 1962).

24558 NEW PROBLEMS AND OPPORTUNITIES IN RADIATION OF THE DEVELOPING NERVOUS SYSTEM. Samuel P. Hicks (New England Deaconess Hospital, Boston). Trans. Am. Nuclear Soc., 5: No. 1, 189-90(June 1962).

24559 THE HARMFUL GENETIC EFFECTS OF RADIATION. H. H. Plough (Amherst Coll., Amherst, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 190-1(June 1962).

24560 HARMFUL SOMATIC EFFECTS OF RADIATION. William A. Meissner (New England Deaconess Hospital, Boston). Trans. Am. Nuclear Soc., 5: No. 1, 191-2 (June 1962).

24561 A REVIEW OF THERAPEUTIC VALUE OF ISOTOPES INCLUDING NEUTRON CAPTURE THERAPY. Gordon L. Brownell and Kathleen Stratton (Massachusetts General Hospital, Boston). Trans. Am. Nuclear Soc., 5: No. 1, 192(June 1962).

24562 NUCLEAR AND RADIOCHEMICAL TECHNIQUES IN CHEMICAL ANALYSIS. H. L. Finston (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 192-3(June 1962).

24563 IMPROVED TECHNIQUES FOR THE MEASUREMENT OF SHORT-LIVED FISSION GASES. C. W. Townley, N. E. Miller, T. S. Elleman, and D. N. Sunderman (Battele Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 193(June 1962).

24564 RADIOCHEMICAL SEPARATION TECHNIQUES FOR SHORT-LIVED FISSION PRODUCTS. Charles W. Townley, Thomas S. Elleman, and Duane N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 194-5(June 1962).

24565 APPLICATION OF RADIOISOTOPE METHODOLOGY TO THE DETERMINATION OF ARSENIC IN COPPER ALLOYS AND IN ORGANIC MATERIALS. A. P. Grimanis and G. W. Leddicotte (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 195(June 1962).

24566 HALF-LIFE OF Cs-137. B. F. Rider, J. P. Peterson, Jr., and C. P. Ruiz (General Electric Co., Pleasanton, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 195(June 1962).

24567 STUDY OF THE RADIATIONS FROM Br-87. Evan T. Williams and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 196(June 1962).

24568 SURFACE ANALYSIS BY MEANS OF NUCLEAR PARTICLE SCATTERING. W. W. Buechner and J. E. Robertshaw (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nuclear Soc., 5: No. 1, 197(June 1962).

24569 SURFACE COMPOSITION STUDIES BASED ON NUCLEAR BOMBARDMENT DATA. Farno L. Green (General Motors Research Labs., Warren, Mich.), M. D. Cooper, and J. E. Robertshaw. Trans. Am. Nuclear Soc., 5: No. 1, 197-8(June 1962).

24570 CALIBRATION OF AN ISOTOPIC NEUTRON SOURCE FOR INTRINSIC-TRACER PROCESS CONTROL. J. L. McFarling, P. Gluck, J. F. Kircher, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 198-9(June 1962).

24571 AN INSTRUMENT FOR MONITORING AIRBORNE BERYLLIUM. J. W. Haffner, R. S. Bramen, and J. F. Wakeman (Illinois Inst. of Tech., Chicago). Trans. Am. Nuclear Soc., 5: No. 1, 199(June 1962).

24572 MATERIAL IDENTIFICATION BY THE $(n,\alpha\gamma)$ REACTION IN BORON. E. D. Jordan (Catholic Univ. of America, Washington, D. C.). Trans. Am. Nuclear Soc., 5: No. 1, 199-200(June 1962).

24573 THE ANALYSIS OF SILICON IN CAST IRON BY FAST NEUTRON ACTIVATION. R. J. Kinsey (General Motors Research Labs., Warren, Mich.) J. P. Danforth, F. L. Green, W. Kerwick, and R. E. Kohn. Trans. Am. Nuclear Soc., 5: No. 1, 200-1(June 1962).

24574 THE DETERMINATION OF SILICON IN ALUMINUM ALLOY BY FAST NEUTRON ACTIVATION ANAL-

TSS. Robert E. Kohn and Farno L. Green (General Motors Research Labs., Warren, Mich.). Trans. Am. Nuclear Soc., 5: No. 1, 201(June 1962).

24575 PROGRESS IN RADIOREAGENT TECHNIQUES. E. A. Reynolds (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 202(June 1962).

24576 THE APPLICATION OF RADIOACTIVE CLATHRATES TO GAS MONITORING. Frederick J. Brousaides, Richard L. Bersin, and Carleton O. Hommel (Traceriab, Inc., Waltham, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 202-3(June 1962).

24577 A RADIOMETRIC TECHNIQUE FOR DETERMINATION OF DISSOLVED OXYGEN IN PURE AND ENVIRONMENTAL WATERS. Arthur S. Gillespie, Jr. and Harold G. Richter (Research Triangle Inst., Durham, N. C.). Trans. Am. Nuclear Soc., 5: No. 1, 203(June 1962).

24578 LIQUID SCINTILLATION COUNTING OF TRITIUM—IMPROVEMENTS IN SENSITIVITY BY EFFICIENT LIGHT COLLECTION. Royal H. Benson and R. L. Mante (Monsanto Chemical Co., Texas City, Tex.). Trans. Am. Nuclear Soc., 5: No. 1, 203-4(June 1962).

24579 SEPARATION OF GAMMA-RAY PULSES FROM NEUTRON PULSES IN NaI(Tl) DETECTORS. R. A. Karam and J. A. Wethington, Jr. (Univ. of Florida, Gainesville). Trans. Am. Nuclear Soc., 5: No. 1, 204-5(June 1962).

24580 A NEW MASS FLOW TECHNIQUE USING RADIOISOTOPES. J. W. Haffner (Illinois Inst. of Tech., Chicago) and W. K. Genthe. Trans. Am. Nuclear Soc., 5: No. 1, 205(June 1962).

24581 METHOD FOR PREPARATION OF TRITIUM LABELED OLEFINS. Smith L. Holt and Preston Gant (Continental Oil Co., Ponca City, Okla.). Trans. Am. Nuclear Soc., 5: No. 1, 205-6(June 1962).

24582 RADIOISOTOPIC STUDY OF GYRO BEARING LUBRICATION PROBLEMS. W. H. Lange, W. J. Mayer, and T. F. Conners (General Motors Corp., Danville, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 206(June 1962).

24583 LOW ENERGY PHOTON EMISSION FROM RADIOISOTOPES. Farno L. Green (General Motors Research Labs., Warren, Mich.). Trans. Am. Nuclear Soc., 5: No. 1, 207(June 1962).

24584 YTTERBIUM-169 FOR INDUSTRIAL RADIOGRAPHY. H. A. Burley, C. P. Moore, F. L. Green (General Motors Research Labs., Warren, Mich.) and R. W. Shuman. Trans. Am. Nuclear Soc., 5: No. 1, 207(June 1962).

24585 LEAK TESTING AUTOMOTIVE SEALED BEAM HEADLAMP UNITS USING RADIOACTIVE GAS AND AUTORADIOGRAPHY. B. L. Burgan and L. L. Jemison (General Motors Corp., Anderson, Ind.). Trans. Am. Nuclear Soc., 5: No. 1, 208-9(June 1962).

24586 THE BROOKHAVEN CHEMONUCLEAR IN-PILE TEST LOOP. W. Tucker, C. Waide, P. Bezler and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 209-10(June 1962).

24587 NITROGEN DIOXIDE FORMATION IN LIQUID AIR BY FAST NEUTRONS. R. C. Axtmann, J. Bridgwater, and P. Mulás (Princeton Univ., N. J.). Trans. Am. Nuclear Soc., 5: No. 1, 210(June 1962).

24588 RADIATION-INDUCED ALKYLATION OF AROMATICS IN THE GAS PHASE. P. Y. Feng (Illinois Inst. of Tech., Chicago), B. K. Krotoszynski, and T. D. Nevitt. Trans. Am. Nuclear Soc., 5: No. 1, 210-11(June 1962).

24589 FISSION FRAGMENT IRRADIATION OF METHANE. C. W. Farley and W. A. Lloyd (Pennsylvania State Univ., University Park). Trans. Am. Nuclear Soc., 5: No. 1, 211-12(June 1962).

24590 APPLICATION OF DIFFUSION CALCULATIONS TO EVALUATION OF N-16 SPECIFIC ACTIVITY. K. Shure and N. R. Williamsen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 213(June 1962).

24591 GAMMA DOSE FROM SOLAR FLARE PROTONS INCIDENT ON AN ALUMINUM SHIELD. Richard Madey, Arthur G. Duneer, Jr., and Theodore J. Krieger (Republic Aviation Corp., Farmingdale, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 213-14(June 1962).

24592 LOW-ENERGY NEUTRON SPECTRA IN LITHIUM HYDRIDE. V. V. Verbinski (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 214-15(June 1962).

24593 SHIELDING STUDIES FOR A POWER REACTOR. H. S. Davis, E. G. Peterson, and W. L. Bunch (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 215(June 1962).

24594 THE SHIELDING PROGRAM FOR SNAP REACTOR SYSTEMS. Walter M. Cegelski (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 215-16(June 1962).

24595 THE APPLICATION OF MONTE CARLO CALCULATIONS TO SNAP REACTOR SHIELDS. Kevin L. Rooney and William J. Roberts (Atomics International, Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 216-17(June 1962).

24596 NEUTRON STREAMING IN THE HTGR. R. W. Green and M. Troost (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 217(June 1962).

24597 NEUTRON FLUX DISTRIBUTIONS IN IRON–WATER SHIELDS. R. W. Deutsch (Republic Aviation Corp., Farmingdale, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 217-18(June 1962).

24598 MONTE CARLO CALCULATIONS ON THE REFLECTION AND TRANSMISSION OF SCATTERED γ-RADIATIONS. D. J. Raso (Technical Operations, Inc., Burlington, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 218-19(June 1962).

24599 A SEMI-EMPIRICAL FORMULA FOR DIFFERENTIAL DOSE ALBEDO FOR GAMMA RAYS ON CONCRETE. A. B. Chilton and C. M. Huddleston (U. S. Naval Civil Engineering Lab., Port Hueneme, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 220(June 1962).

24600 THE ANGULAR DISTRIBUTION OF DOSE RATE DUE TO GAMMA RAYS TRANSMITTED THROUGH VARIOUS THICKNESSES OF IRON AND ALUMINUM SLABS. T. S. Dahlstrom and W. E. Thompson (Naval Radiological Defense Lab., San Francisco). Trans. Am. Nuclear Soc., 5: No. 1, 220(June 1962).

24601 PENETRATION OF POINT MONODIRECTIONAL GAMMA RAYS THROUGH SLAB SHIELDS. K. Shure (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 221-2(June 1962).

24602 APPLICATION OF THE SPHERICAL HARMONICS TECHNIQUE TO PROBLEMS IN GAMMA TRANSPORT. W. D. Lanning (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 222(June 1962).

24603 A STUDY OF GEOMETRY AND BARRIER ATTENUATION GENERATED BY A VERTICAL SLAB EXPOSED TO A PLANE Co-60 SOURCE. G. E. Plummer (Naval Radiological Defense Lab., San Francisco). Trans. Am. Nuclear Soc., 5: No. 1, 222-3(June 1962).

24604 GAMMA-RAY SCATTERING BY NEARBY SURFACES. Eric T. Clarke and John Batter (Technical Operations, Inc., Burlington, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 223-4(June 1962).

24605 SOME USEFUL TECHNIQUES FOR MONTE CARLO CALCULATIONS AND THEIR EFFECTIVENESS. Salvador B. Layno (Boeing Airplane Co., Seattle). Trans. Am. Nuclear Soc., 5: No. 1, 224(June 1962).

24606 HIGH TEMPERATURE PROPERTIES OF CERAMIC FUELS: THEIR SIGNIFICANCE AND MEASUREMENT. J. A. L. Robertson (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Trans. Am. Nuclear Soc., 5: No. 1, 225-6(June 1962).

24607 RECRYSTALLIZATION IN ThO_2-UO_2 DURING IRRADIATION. L. A. Neimark (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 226-8(June 1962).

24608 IRRADIATION OF URANIUM DIOXIDE SINGLE CRYSTAL. J. L. Bates, J. A. Christensen, and J. L. Daniel (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 228(June 1962).

24609 URANIUM DIOXIDE–CLADDING INTERACTIONS: AXIAL EXPANSION OF UO_2 COLUMN IN FUEL ELEMENTS. C. N. Spalaris (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 228-9 (June 1962).

24610 HIGH TEMPERATURE SUBSTOICHIOMETRY IN URANIUM DIOXIDE. E. Rothwell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Am. Nuclear Soc., 5: No. 1, 229-30(June 1962).

24611 IRRADIATION BEHAVIOR OF U–C FUELS. B. A. Webb and R. D. Hahn (Atomics International Canoga Park, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 230 (June 1962).

24612 AN ANALYTICAL INVESTIGATION OF MATRIX FAILURE IN DISPERSION FUEL PLATES. Stephen D. Beck (Alco Products, Inc., Schenectady, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 230-1(June 1962).

24613 BERYLLIUM SHEATHED UO_2 FUEL ELEMENT IRRADIATION TESTS. M. F. Osborne, A. E. Goldman, E. L. Long, Jr., F. R. McQuilkin, and J. G. Morgan (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 231-2(June 1962).

24614 IN-PILE FISSION GAS RELEASE FROM UO_2. J. B. Melehan and F. A. Rough (Battelle Memorial Inst., Columbia, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 232-3(June 1962).

24615 RELEASE OF FISSION PRODUCTS BY THE IN-PILE MELTING OF URANIUM DIOXIDE FUEL. C. E. Miller, Jr., R. P. Shields, B. F. Roberts, and W. E. Browning, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 233(June 1962).

24616 THE IRRADIATION BEHAVIOR OF ZrO_2-UO_2 FUELS. B. Rubin, R. M. Berman, and M. L. Bleiberg (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 233-4(June 1962).

24617 THE HIGH TEMPERATURE BEHAVIOR IN WATER OF UO_2 CORE, STAINLESS STEEL-304 CLAD FUEL PINS DURING REACTOR TRANSIENTS. Robert C. Liimatainen, Richard O. Ivins, and David C. Hill (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 234-5(June 1962).

24618 RESULTS OF IRRADIATION TESTS OF THIN-WALL STAINLESS STEEL CLAD, UO_2 FUEL RODS. J. W. Lingafelter, T. J. Pashos, C. N. Spalaris, and H. E. Williamson (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 235(June 1962).

24619 XENON RELEASE FROM RECOIL DAMAGED ALUMINA. D. L. Morrison, R. H. Barnes, T. S. Ellemas, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 235-6(June 1962).

24620 OUT-OF-PILE THERMAL TESTING OF UO_2 FUEL ELEMENTS. Andrew J. Anthony, Charles E. Burdg, and Robert J. Sanderson (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nuclear Soc., 5: No. 1, 236-7(June 1962).

24621 VIBRATORY COMPACTION OF UO_2 FUEL ELEMENTS FOR USE IN CRITICAL EXPERIMENTS. C. E. Burdg, D. E. Nulk, B. E. Murtha, and W. P. Chernock (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nuclear Soc., 5: No. 1, 237-8(June 1962).

24622 OXIDATION OF UO_2 AND $BeO-UO_2$ FUEL PELLETS CONTAINED IN DEFECTED FUEL PINS IN OXIDIZING REACTOR GAS COOLANTS. J. S. Brunhouse and G. W. Titus (Aerojet-General Nucleonics, San Ramon, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 238(June 1962).

24623 HIGH TEMPERATURE IRRADIATION OF UO_2–BeO BODIES. J. H. Saling (Battelle Memorial Inst., Columbus, Ohio) and G. W. Titus. Trans. Am. Nuclear Soc., 5: No. 1, 238-9(June 1962).

24624 CENTRAL MELTING IN UO_2 FUEL. M. F. Lyons (General Electric Co., San Jose, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 239-40(June 1962).

24625 THE DEVELOPMENT AND TESTING OF HIGHLY ENRICHED HOMOGENEOUS CERAMIC FUELS. G. Zuromsky and W. P. Chernock (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nuclear Soc., 5: No. 1, 240(June 1962).

24626 THE PYROLYTIC CARBON COATING OF CERAMIC FUEL FOR THE SECOND SHIPPINGPORT REACTOR. L. J. Goetz and W. H. Britton (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 240-1(June 1962).

24627 FISSION GAS RELEASE FROM PROTOTYPE PEBBLE BED REACTOR FUEL ELEMENTS. R. C. Koch, G. L. Grandy, and C. R. Wilson (Nuclear Science and Engineering Corp., Pittsburgh). Trans. Am. Nuclear Soc., 5: No. 1, 241(June 1962).

24628 STEADY-STATE RELEASE FRACTION OF KRYPTON AND XENON FISSION PRODUCTS AT HIGH TEMPERATURES FROM $(U,Th)C_2$–GRAPHITE FUEL MATRIX IN OUT-OF-PILE EXPERIMENTS. E. E. Anderson, P. E. Gethard, and L. R. Zumwalt (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 241-2(June 1962).

24629 SINTERING OF URANIUM MONOCARBIDE PRECIPITATED FROM LIQUID METAL MEDIA. T. R.

Johnson, G. D. White, J. H. Handwerk, and R. Steunenberg (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 243-4(June 1962).

24630 EVALUATION OF THORIUM AND THORIUM–URANIUM COMPOUNDS. M. S. Farkas, A. A. Bauer, and B. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 244(June 1962).

24631 FABRICATION AND PROPERTIES OF US AND ThS BODIES. P. D. Shalek (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 244-5(June 1962).

24632 SOME IRRADIATION CHARACTERISTICS OF METASTABLE BETA-PHASE URANIUM. Harry M. Green (Nuclear Metals, Inc., Concord, Mass.). Trans. Am. Nuclear Soc., 5: No. 1, 245-6(June 1962).

24633 NIOBIUM–URANIUM ALLOYS FOR ELEVATED TEMPERATURE FUEL APPLICATIONS. J. A. DeMastry, A. A. Bauer, and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 246-7(June 1962).

24634 FABRICATION OF DEFECT-FREE SMALL DIAMETER ZIRCONIUM ALLOY TUBING. C. H. Bean and N. H. Polakowski (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 247-8(June 1962).

24635 EVALUATION AND ASSEMBLY BY VACUUM BRAZING OF THE SUPERHEATER FUEL PLATES FOR THE BOILING REACTOR EXPERIMENT-V. W. C. Kramer and C. H. Bean (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 248(June 1962).

24636 RADIATION DAMAGE DOSE RATES IN DIFFERENT REACTOR SPECTRA. A. D. Rossin (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 249(June 1962).

24637 IRRADIATION OF A 19-ROD BUNDLE FUEL ELEMENT. H. C. Hopkins, Jr. (General Atomic Division, General Dynamics Corp., San Diego). Trans. Am. Nuclear Soc., 5: No. 1, 249-50(June 1962).

24638 AN ESTIMATE OF THE EFFECT OF NEUTRON-ENERGY SPECTRUM ON RADIATION DAMAGE OF STEEL. H. C. Claiborne (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 250-2(June 1962).

24639 IRRADIATION-INDUCED PROPERTY CHANGES IN TANTALUM. F. R. Shober, C. K. Franklin, D. Stahl, and R. F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 252 (June 1962).

24640 THE IRRADIATION TESTING OF A PLUTONIUM FUEL ELEMENT CONCEPT AT HANFORD. W. J. Bailey, M. D. Freshley, and R. E. Sharp (General Electric Co., Richland, Wash.). Trans. Am. Nuclear Soc., 5: No. 1, 252-3(June 1962).

24641 A NEUTRON FILTER FOR IRRADIATION TESTING OF FAST REACTOR FUEL ELEMENTS IN A THERMAL REACTOR. Earl M. Page (Astra, Inc., Raleigh, N. C.) and W. G. Blessing. Trans. Am. Nuclear Soc., 5: No. 1, 254-5(June 1962).

24642 EXPERIMENTAL MELTDOWN STUDIES OF IRRADIATED NUCLEAR FUEL. J. E. Gates, D. G. Freas (Battelle Memorial Inst., Columbus, Ohio) and J. M. Morelle. Trans. Am. Nuclear Soc., 5: No. 1, 255(June 1962).

24643 IN-PILE GAS-COOLED UNCLAD FUEL ELEMENT TEST FACILITY. J. Zasler, P. A. Gnadt, W. R. Huntley, and T. S. Kress (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 255-6(June 1962).

24644 EFFECT OF BURNUP ON DAREX AND SULFEX HEAD-END PROCESSES. R. A. Ewing, H. B. Brugger, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nuclear Soc., 5: No. 1, 256 (June 1962).

24645 THE "PHOSFLUOR" PROCESS FOR REPROCESSING CERAMIC FUELS. R. Johnson, F. L. Horn, and G. Strickland (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nuclear Soc., 5: No. 1, 256-7(June 1962).

24646 THE MECHANISM OF EXTRACTION OF WATER AND NITRIC ACID BY TRIBUTYL PHOSPHATE–HEXANE SOLVENTS. Donald R. Olander (Univ. of California, Berkeley) and M. Benedict. Trans. Am. Nuclear Soc., 5: No. 1, 257-8(June 1962).

24647 THE RECOVERY OF IRRADIATED URANIUM BY A TWO-STAGE DIFFERENTIAL EXTRACTION PROCEDURE. R. E. McHenry, J. C. Posey, and P. S. Baker (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 258(June 1962).

24648 CHARACTERIZATION OF GAS-BORNE RADIOACTIVE MATERIALS BY A DIFFUSION CELL TECHNIQUE. W. E. Browning, Jr. and R. D. Ackley (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 258-9(June 1962).

24649 REMOVAL OF RADIOIODINE VAPOR FROM GASES AT ELEVATED TEMPERATURES. Robert E. Adams and William E. Browning, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nuclear Soc., 5: No. 1, 259 (June 1962).

24650 DESIGN AND CONSTRUCTION OF A SINGLE-CRYSTAL NEUTRON SPECTROMETER AND ITS USE IN A REACTOR TRAINING LABORATORY. Jan Spalek (Argonne National Lab., Ill.). Trans. Am. Nuclear Soc., 5: No. 1, 260-1(June 1962).

24651 DEVELOPMENT OF LIQUID-METAL HEAT-TRANSFER FACILITY FOR UNIVERSITY USE. Richard Jamron and Frederick G. Hammitt (Univ. of Michigan, Ann Arbor). Trans. Am. Nuclear Soc., 5: No. 1, 261-2(June 1962).

24652 DIGITAL APPROXIMATION OF DIFFERENTIAL EQUATIONS USING TRAPEZOIDAL CONVOLUTION. Charles A. Halijak (Kansas State Univ., Manhattan). Trans. Am. Nuclear Soc., 5: No. 1, 262-3(June 1962).

24653 ATOMIC DEFENSE ENGINEERING EDUCATION. J. C. LeDoux (U. S. Naval School, Port Hueneme, Calif.). Trans. Am. Nuclear Soc., 5: No. 1, 263(June 1962).

24654 NUCLEAR QUADRUPOLE COUPLING IN IONIC MOLECULES. A. D. Buckingham (Oxford Univ.). Trans. Faraday Soc., 58: 1277-83(July 1962).

The electric field gradient at the nucleus of a spherical ion placed in an external electric field F_z with a gradient F^0_{zz} is assumed to be $-eq = (1 + \gamma)F^0_{zz} + \epsilon F^2_{zz}$, where γ is the antishielding factor and is of the order of 100 for the heavier ions. If ϵ and γ are both positive, the two contributions to q reinforce one another when F_z and F^0_{zz} arise from an

external negative charge and tend to cancel each other near a positive charge. By applying this model to the alkali halide molecules, it is found possible to explain the observed nuclear quadrupole coupling constants, and their variation with the vibrational quantum number v, in terms of a single set of values for ϵ and γ. The quadrupole moments Q of the alkali metal nuclei and the dependence of e^2qQ on the rotational quantum number J are obtained. (auth)

24655 THE MÖSSBAUER EFFECT. A Review—with a Collection of Reprints. Hans Frauenfelder. Frontiers in Physics. A Lecture Note and Reprint Series. New York, W. A. Benjamin, Inc., 1962. 349p.

A review of the properties and applications of the Mössbauer effect is presented. Reprints of 41 articles are given, following a general introduction. (L.N.N.)

Astrophysics and Cosmology

24656 (ML-879) ELECTRODYNAMIC PROBLEMS OF ASTROPHYSICS. Technical Status Report No. 5, October 1 to December 31, 1961. P. A. Sturrock (Stanford Univ., Calif. Microwave Lab.). Jan. 1962. Contract AF 49(638)-342. 12p. (AD-271004)

The origin of radiation at the second harmonic of the plasma frequency is set forth as the nonlinear mechanism which couples two plasma oscillations to one electromagnetic wave. This is at variance with the suggestion that radiation at the second harmonic is to be attributed to scattering of the excited plasma oscillations from thermal fluctuations of the plasma at the plasma frequency. The difficulty in comparing radiation by the two mechanisms is that one would expect the wave-number spectra of the two types of excitation of the plasma to be quite different. In the case that the spectra are similar, it can easily be demonstrated that radiation by the nonlinear mechanism is more important than that due to the Ginzburg-Zheleznyakov mechanism. (auth)

24657 (R62SD30) INTERACTION OF A PLASMA STREAM WITH THE GEOMAGNETIC FIELD. C. M. Tchen (General Electric Co. Missile and Space Vehicle Dept., Philadelphia). Mar. 1962. 19p.

The interaction between a stream of solar corpuscles and the geomagnetic field represented by a three-dimensional dipole singularity is investigated. An approximate method is developed for estimating the size and shape of the stationary interface between the plasma stream and the magnetic field. The same method is also applied to the corresponding problems in two dimensions, where the magnetic fields are represented by a dipole and a line source. (auth)

24658 NUCLEOSYNTHESIS DURING THE EARLY HISTORY OF THE SOLAR SYSTEM. William A. Fowler, Jesse L. Greenstein, and Fred Hoyle. Geophys. J., 6: 148-220(1962).

Abundances in terrestrial and meteoritic matter indicate that the synthesis of D^2, Li^6, Li^7, Be^9, B^{10}, and B^{11}, and possibly C^{13} and N^{15} occurred during an intermediate stage in the early history of the solar system. Planetary material became largely separated, but not completely, from the hydrogen which was the main constituent of primitive solar material. The synthesis occurred through spallation and neutron reactions simultaneously induced in the outer layers of the planetesimals by the bombardment of high energy charged particles, mostly protons, accelerated in magnetic flares at the surface of the condensing sun. Studies of the abundance of Li in young T Tauri stars serve as the primary astronomical evidence for this point of view. The observed abundances of Li and Be in the surface of the sun are discussed in terms of the astronomical and nuclear considerations brought forward. The isotope ratios $D^2/H^1 = 1.5 \times 10^{-4}$, $Li^6/Li^7 = 0.08$, and $B^{10}/B^{11} = 0.22$ are the basic data leading to the requirement that 10% of terrestrial-meteoritic material was irradiated with a thermal neutron flux of 10^7 years. It is shown that the neutron flux was sufficient to produce the radioactive Pd^{107} and I^{129} necessary to account for the radiogenic Ag^{107} and Xe^{129} anomalies recently observed in meteorites. (P.C.H.)

24659 NEUTRINO ASTRONOMY. Hong-yee Chiu. Intern. Sci. and Technol., No. 8, 26-32(Aug. 1962).

Discussion is given on the discovery and detection of the neutrino and aspects of neutrino astronomy now that it is recognized that neutrinos can affect the evolution of stars. For stars whose interior temperature exceeds about 600 million degrees, a new neutrino production process is proposed: the annihilation of electron-antineutrino pairs. This new mechanism radically alters the view of how a star becomes a supernova. (P.C.H.)

Cosmic Radiation

24660 (AROD-2774:2) [THE PRIMARY COSMIC RADIATION]. Final Report, 1959–1961. M. W. Friedlander (Washington Univ., St. Louis). Contract DA-ORD-30. 9p.

The results of an investigation of the fluxes and energy spectra of alpha particles and heavier nuclei in the primary cosmic radiation, using nuclear emulsions exposed at high altitudes by means of balloons during the period December 1959 to December 1961 are summarized. A brief discussion of each flight made is given. (auth)

24661 (NASA-TN-D-1291) SOLAR PROTON IMPACT ZONES. Thomas Kelsall (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.). June 1962. 33p.

The trajectories of charged particles moving in a magnetic dipole field were calculated by numerical integration for application to data on the intensity variation of cosmic rays during recent solar events. All seasons and times of day were covered by assuming a range of orientations of the incident particle beam with respect to the magnetic dipole axis. The points of impact with the earth have been determined for protons at 0.05 to 50 Bev. The computation includes 4000 trajectories and fills several gaps in previous investigations. In agreement with earlier calculations the results indicate that the protons strike in well defined areas between 0 and 1200 hours local time and are focused into small areas of impact at low energies. The investigation showed two facts which are not new, but which have received little attention in earlier work. First, the relative number of impacts in the northern and southern geomagnetic hemispheres is strongly dependent on season. Second, under certain conditions of season there is a class of trajectories which may be called quasi-trapped, consisting of a set of paths which resemble the trapped trajectories first discovered by Störmer but which are connected to infinity. It is suggested that injection into trapped orbits from these quasi-trapped trajectories may make a contribution to the population of the Van Allen belts. (auth)

24662 (PAN-291/VI) INTERACTIONS OF NUCLEONS WITH HEAVY NUCLEI OF PHOTOGRAPHIC EMULSIONS OF ENERGIES HIGHER THAN 10^{12} ev. Jerzy Gierula, Roman Holynski, and Marian Miesowicz (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Dec. 1961. 9p.

The angular distribution of secondary particles of 14 jets with primary energy $>10^{12}$ ev, characterized by high evaporation and very high multiplicity were analyzed. It was found that in central collisions of nucleons with heavy nuclei of photographic emulsions there is a very significant effect of double maximum angular distribution. The double maximum structure becomes more pronounced with increasing anisotropy of angular distribution. In jets with very well separated narrow and diffuse cones, there is an asymmetry in number and shape of both cones. These facts can be explained on the basis of the two-center model taking into account the secondary interactions of particles created in the "slow-center" with the target nucleus. (auth)

24663 THE DIAMAGNETISM OF THE VAN ALLEN ZONES AS A POSSIBLE SOURCE OF THE EXTERNAL MAGNETIC FIELD OF THE EARTH. Miexzysław Kozłowski (Univ. of Warsaw). Acta Geophys. Polon., 8: 287-311 (1960).

Approximate expressions for potential, and intensity of the magnetic field on the earth's surface, derived from the Van Allen zones are given on the assumption of the diamagnetic behavior of their gas. The zones are assumed as single layers magnetized along the lines of force of the geomagnetic field. The contribution to the external field is comparatively so high that the diamagnetic properties of the Van Allen zones must be taken into account in considerations on the origin of the external magnetic field of the earth as well as of the cause of the magnetic storms. (Meteorol. Geoastrophys. Abstr. 13, No. 1, Jan. 1962)

24664 USE OF THE TERRESTRIAL MAGNETIC FIELD FOR THE STUDY OF COSMIC RAYS OR MAGNETIC ACTIVITY. Pierre-Noel Mayaud. Ann. geofis. (Rome), 11: 131-7(Apr. 1958).

An attempt is made to show how the use of a conventional field, intermediate between the values of the dipole field and those of the real field at Earth level, which previously helped to explain such discrepancies in the case of magnetic activity results, also makes it possible to explain similar discrepancies in cosmic ray results. Attention is thus directed towards the fact that the geomagnetic coordinates may perhaps have to be abandoned in the interpretation of geophysical phenomena. (Meteorol. Geoastrophys. Abstr., 13, No. 2, Feb. 1962)

24665 INVESTIGATIONS ON THE ISOTROPY OF HIGH ENERGY COSMIC RAYS. John Paul Delvaille (Cornell Univ., Ithaca, N. Y.). Dissertation Abstr., 22: 4378 (June 1962).

The directional distribution of cosmic rays was measured in the energy range 10^{13} to 10^{19} ev. Two methods were used, both employing the detection of extensive air showers (EAS) by an array of 15 plastic scintillation detectors covering an area of ~ 1 km^2. For EAS containing less than 10^7 particles, the counting rates of simple multiple coincidences were Fourier analyzed (after suitably correcting for atmospheric effects) to obtain the variation in cosmic ray flux in sidereal right ascension. In the region above 10^7 particles, the method of fast-timing and pulse height measurements gave the individual directions of the primary particles as well as the shower sizes. The results may be summarized as follows: (i.) In the interval 1×10^{13} to 10^{16} ev, the flux of cosmic rays is isotropic to 0.5%. Most of the experiments in this field (including the present one) indicate a positive excess of flux in the vicinity of the galactic center or inward spiral arm. However, some discussion is presented concerning the effects of uncompensated, seasonal atmospheric modulations on these measurements. In particular, not only is it possible that such modulations could account for the majority of the results but it is felt that solar diurnal phase modulation may ultimately set an upper limit to the accuracy with which time variation experiments may be performed. (ii.) There seems to be a curious second harmonic (amplitude 17 ± 5%; time of max. 9.7^{hr}, 21.7^{hr}) in the range 10^{17} to 10^{18} ev. (iii.) Some anisotropy corresponding to an excess of flux in the galactic disc may be present for energies greater than 10^{18} ev. (iv.) Nine events were observed with energies well in excess of one joule; they appear to be isotropic. In addition, experimental data on the fluctuations in the average radius of curvature of the shower from (2.85 ± 0.04 km) are presented.

24666 COSMIC RAY INCREASES DURING THE SUNSPOT MINIMUM OF 1953. J. N. Tandon (Univ. of Delhi). J. Atmospheric and Terrest. Phys., 21: 203-5(June 1961).

Geomagnetic sequence associated with a most pronounced u.m.-region of 1953 was analyzed. It was concluded that the trapped particles of the solar ion streams in the radiation belt may be responsible for the increases in cosmic ray intensities associated with quite M-storms. In this way, the radiation belt acts as the secondary source of cosmic ray particles. During the sunspot maximum period, these increases of cosmic ray intensity will get masked on account of very many solar-ion streams of large frozen-in magnetic fields. Hence, observations of such increases in cosmic rays during the high sunspot period should not be expected. (Meteorol. Geoastrophys. Abstr., Feb. 1962)

24667 SOLAR MAGNETIC CLOUD PRODUCING COSMIC-RAY STORM, MAGNETIC STORM AND TYPE IV SOLAR RADIO OUTBURST. Yoshiko Kamiya (Nagoya Univ., Japan). J. Geomagnet. Geoelec., 13: 33-41(1961). (In English)

In order to find the cause of cosmic-ray storms, the correlation of the spectral type of solar radio outbursts and cosmic-ray variations and magnetic activities is studied using data obtained from July 1957 to December 1960. Cosmic-ray storms are found to be closely associated with radio outbursts of Type IV (continuum). This result indicates that the eruption followed by the radio outburst of Type IV is the cause of cosmic-ray storms. The size of cosmic-ray and magnetic storm is compared with the heliographic longitude of the eruptions. Large magnetic storms occur after eruptions near the central meridian, while the size of the cosmic-ray storm is independent of the heliographic longitude of the eruption. From these results, a possible model of a magnetized corpuscular cloud is presented, which seems to be ejected from the sun during eruption followed by Type IV outburst. This model of the magnetic cloud consists of a large total bulk with a core and appears to be able to consistently explain not only the facts described but also other earth storms. (auth)

24668 EFFECT OF SOLAR COSMIC RAYS ON THE METEORITE RADIOACTIVITY. Satio Hayakawa (Nagoya Univ., Japan). J. Geomagnet. Geoelec., 13: 61-2(1961). (In English)

The Ar^{37}/Ar^{39} ratio of a chondritic meteorite that fell on Oct. 13, 1959, three months after the intense (flux $\approx 4 \times 10^9$ protons/cm^2) solar proton event in July 1959, is studied. It is concluded that this ratio suggests the cosmic-ray flux is higher near the sun than near the earth. (T.F.H.)

24669 CHARGE RATIO OF HIGH-ENERGY COSMIC RAY MUONS. P. J. Hayman and A. W. Wolfendale (University of Durham, Eng.). Nature, 195: 166-7(July 14, 1962).

Results are given of the ratio of the number of positively charged to negatively charged muons in the vertical cosmic radiation at Durham (200 ft above sea level) in the momentum range 5 to 1000 Bev/c. Comparison of the data with other results shows that there is general agreement up to about 20 Bev/c. Two cases are considered in which the measured charge ratio can be used to give information on the nature of the interactions in which the parents of the muons are produced. The cases are: that the majority of muons come from pions which are generated directly in the interactions of the primary cosmic rays (or their secondaries), and that an intermediate hyperon plays a predominant part at high momenta. It is concluded that the present measurements of the charge ratio of muons at sea level are consistent with a pion source in which the fluctuations increase with energy. The results are inconsistent, however, with the predictions of a hyperon model previously proposed. (P.C.H.)

24670 ON THE METHODS GENERALLY USED TO COMPENSATE THE ATMOSPHERIC EFFECTS OF THE MUON COMPONENT OF THE COSMIC RADIATION. T. Sándor, A. Somogyi, and F. Telbisz (Central Research Inst. of Physics, Budapest). Nuovo cimento (10), 23: 1080-8(Mar. 16, 1962). (In English)

On the basis of the muon intensity observed from 1958 to 1960 at a depth of 40 mwe, methods used for correcting the atmospheric effects of the muon component are compared. One method is found that gives a significantly smaller residual mean square deviation than others. The observed muon intensity shows a strong negative correlation with the height of the 200-mb isobaric level, and a negative correlation is also found with the temperature of the stratosphere. (auth)

24671 THE ACCELERATION OF PARTICLES IN THE OUTER ATMOSPHERE. Tatsuzo Obayashi (Hiraiso Radio Wave Observatory Radio Research Lab., Japan). Rept. Ionosphere Space Research Japan, 13: 123-5(1959).

A theoretical mechanism to explain the presence of high energy particles in the outer atmosphere is presented. It is maintained that the energetic particles are being produced in the Earth's outer atmosphere rather than that they are injected from the outside or trapped by the geomagnetic field. It is concluded that the hydromagnetic oscillations in the outer atmosphere are responsible for producing the high intensity flux of energetic particles surrounding the Earth. (Meteorol. Geoastrophys. Abstr., 13, No. 1, Jan. 1962)

24672 IRON METEORITES AS SPACE PROBES FOR THE INVESTIGATION OF THE INTENSITY VARIATIONS OF COSMIC RADIATION DURING THE LAST MILLION YEARS. H. Voshage (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 17a: 422-32(May 1962). (In German)

The use of iron meteorites for the establishment of possible long-time variations (10^8 to 10^9 years) of the cosmic ray intensity in interplanetary space is based upon the study of the production rates of nuclides which are formed by the interaction of cosmic ray particles with nuclei in meteorites. Mass spectrometric measurements of the isotopic composition of meteoritic potassium were combined with data on cosmogenic rare gases and other elements to give $K^{41}-K^{40}$-exposure ages and rare gas production rates. The $K^{41}-K^{40}$-exposure ages are larger than the exposure ages obtained from the study of short-lived activities (e.g., Cl^{36}, A^{39}), by a factor 1.3 to 1.8. This result indicates that the cosmic ray intensity increased during the bombardment history of the meteorites. The data are consistent with the following assumptions: the cosmic ray intensity was constant during most of the bombarding time and increased by a factor of about 1.5 only a few million years ago; and the intensity rose as $I(t) = I_0 e^{-\gamma t}$ with $-1.1 \cdot 10^{-9} \leq \gamma \leq -0.6 \cdot 10^{-9}$ a^{-1}. The consequences of this result for the interpretation of meteorite data are discussed. (auth)

24673 COSMIC RAYS. International Geophysical Year and Cooperation in Czechoslovakia, 1957-1959. Václav Petržílka. Prague, Czechoslovakia Academy of Sciences, 1960. 14p.

During the IGY and IGC valuable experimental results were obtained by observing the variations in the penetrating and neutron components of cosmic rays. These results concerned non-periodic disturbances particularly of the Forbush type, and it is expected that numerical evaluation of the experimental data will provide further information on 1-day and 27-day variations, particularly of the neutron component of cosmic rays. Some of the data obtained are given. (Meteorol. Geoastrophys. Abstr., 13, No. 2, Feb. 1962)

Criticality Studies

24674 (ORNL-TM-230) SUPER-PROMPT-CRITICAL BEHAVIOR OF AN UNMODERATED UNREFLECTED URANIUM–MOLYBDENUM ALLOY ASSEMBLY. J. T. Mihalczo (Oak Ridge National Lab., Tenn.). May 10, 1962. Contract [W-7405-eng-26]. 32p.

The time-dependent behavior was investigated of the neutron population in an unreflected unmoderated cylindrical assembly of 90 wt.% U (93.2 wt.% U^{235}), 10 wt.% Mo alloy following rapid establishment of a super-prompt critical condition with negligible initial neutron population. Reactivity increases up to 11 cents above prompt critical resulted in bursts yielding as many as 1.8×10^{17} fissions with reactor periods as short as 16 μsec and temperature increases as large as 400°C. Pressure waves generated in a portion of the core held in position by an electromagnet for bursts greater than $\sim 6 \times 10^{16}$ fissions initiated the removal of this section about 225 μsec after the peak burst. (auth)

Elementary Particles and Radiations

24675 (AFOSR-2637) A MODEL OF THE PIONIC DECAYS OF Σ-HYPERONS. Physics Department Technical Report No. 252. S. Y. Shieh (Maryland. Univ., College Park). Apr. 1962. Contract AF49(638)-24. 12p.

An investigation was conducted to correlate questions such as those concerning the (ΣΛ) relative parity, the relative sign of the asymmetry parameters $\alpha^0\Sigma \rightarrow p + \pi$ and $\alpha\Lambda \rightarrow N + \pi$, and the ratio of the strong coupling constants $G_{\Sigma\Sigma_\pi}$, $G_\Sigma A_\pi$, and GNN_π in the problem of pionic decays by assuming that Σ-hyperons first transform themselves to Λ-hyperons by strong interactions then decay through ΔNr-weak vortex. (J.R.D.)

24676 (APED-3960) DIFFUSION OF CHARGED PARTICLES IN A SCATTERING MEDIUM. Edwin Blue, John H. Ingold, and W. J. Ozeroff (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). May 1962. 10p.

The diffusion approximation of the more exact transport theory is described and used to calculate the potential and electron density distributions for a simple case. In this simple case, electrons are emitted from a plane source

and flow to a plane collector through the scattering gas under the influence of a density gradient and electric fields due to a combination of space charge fields and externally applied fields. The resultant current-voltage relation involves Bessel functions of order one-third. However, a plot of ln J versus ln V_a, where J is the electric current density and V_a the applied voltage, has a slope which varies from one to two, according to whether the major component of the electric current is the density gradient or the electric field, respectively. These results are compared to those reported earlier in the literature. (auth)

24677 (CEA-2136) CONTRIBUTION A L'ÉTUDE DES RÉACTIONS $\pi^- + p \rightarrow \pi^0 + n$ et $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ AUX ÉNERGIES DES MAXIMA DE LA SECTION EFFICACE TOTALE DE L'INTERACTION π^- NUCLÉON DANS L'ÉTAT DE SPIN ISOBARIQUE $T = 1/2$ (THÈSES). (Contribution to the Study of $\pi^- + p \rightarrow \pi^0 + n$ and $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ Reactions at the Energies of the Maxima of the π^--Nucleon Interaction in the $T = 1/2$ State Total Cross Section (thesis)). René Turlay (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1962. 71p.

Submitted to Université, Paris.

The total cross sections for processes yielding only neutral particles from 300 to 1600 Mev were determined. For this, the number of incident π^- was counted, which interact in a liquid-hydrogen target without giving charged particles in a 4 π counter surrounding the target. The reactions $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ between 300 and 1100 Mev were separated. By supposing that only these two reactions were realized by placing lead absorbers between the target and 4 π counter and by comparing the counting rate for neutral events with and without lead. The transmission measured is a function of the average number of photons produced and therefore of the ratio between the two neutral channels, $\gamma + n$ and $\pi^0 + \pi^0 + n$. The experimental results are discussed and compared to those obtained in the study of photoproduction and the π^- nucleon interaction. (auth)

24678 (GEMP-113) PROGRAM 20-2, A PROGRAM FOR APPROXIMATING CROSS SECTION DEPENDENCE ON ENERGY. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962.

Auxiliary nuclear data program 20-2, GE-NMPO program 481, is a digital computer program that approximates cross section dependence on energy by discontinuous straight line segments across specified energy groups. Output from the program is available on punched cards suitable for input to Monte Carlo programs 18-0, FMC-N, and FMC-G. A printed listing of output is also prepared by the program. Program 20-2 is coded for use on an IBM 7090 having 32,768 magnetic core storage locations. (auth)

24679 (GEMP-115) PROGRAM 20-4, A PROGRAM FOR AVERAGING DIFFERENTIAL SCATTERING CROSS SECTIONS. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962. Contract AT(40-1)-2847. 39p.

Auxiliary nuclear data program 20-4, GE-NMPO program 483, is a digital computer program that computes angular distribution data by averaging differential scattering cross sections over specified energy groups. Output from the program is available on punched cards suitable for input to Monte Carlo programs 18-0, FMC-N, and FMC-G. A printed listing of output is also prepared by the program. Program 20-4 is coded for use on an IBM 7090 having 32,768 magnetic core memory locations. (auth)

24680 (ISS-61/41) CINEMATICA DELLA FOTOPRODUZIONE IN INDROGENO DEL MESONE ω^0 CON MASSA DI 787 Mev. (Kinematics of the Photoproduction in Hydrogen of the ω^0 Meson with Mass of 787 Mev). G. Cortellessa and A. Reale (Italy. Istituto Superiore di Sanita, Rome). Sept. 30, 1961. 19p.

Computer values are tabularly presented for the photoproduction of mesons (ω^0) from hydrogen. The 787 Mev mesons (ω^0) are produced from the following reaction: $\gamma + p \rightarrow p + \omega^0$. (N.W.R.)

24681 (JINR-D-976) HYPERCHARGE AND DEGENERACY IN RESPECT TO ISOTOPIC SPIN. A. M. Baldin and A. A. Komar (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 5p.

A type of symmetry is proposed in which systems and particles with hypercharge equal to zero have no dependence on isotopic spin value. Application of this symmetry gives predictions of new particles, quantum numbers of these particles, and relations between cross sections (for example, equality of cross sections of $\tilde{n}$,p and $\tilde{p}$,p interactions). (auth)

24682 (JINR-P-868) VZAIMODEISTVIE OTRITSATEL'NYKH π-MEZONOV S GELIEM PRI ENERGII 153 Mev. (Interaction of Negative π-Mesons with Helium at an Energy of 153 Mev). Yu. A. Budagov, P. F. Ermolov, F. A. Kushnirenko, and V. I. Moskalev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 32p.

The 153-Mev π^- interaction with He^4 nuclei was investigated using the high pressure diffusion cloud chamber operated in the magnetic field. The total cross section for π^--He interaction, elastic scattering cross section, and cross section for a number of inelastic processes were determined by measuring the total length of the π^- meson tracks in the chamber. The angular distribution of elastic π^--He scattering has a diffraction character, the first minimum being 80° and the second maximum 100°. The optical model calculations of elastic scattering with the square well complex potential $V = V_R + iV_I$ have shown that the best agreement with the experimental data can be obtained for the values of the parameters $V_R = -(18 \pm 7)$ Mev, $V_I = -(63 \pm 6)$ Mev, and $r_0 = 1.5 \times 10^{-13}$ cm. These values are consistent with those calculated by Frank, Gammel, and Watson from the relation connecting the optical potential with the forward scattering amplitude for free π-p scattering. The angular distribution of the quasi-elastic π^- meson scattering on the bound nucleons is compared with Watson's and Zemach's calculations. The probabilities of the multiple π^- meson scattering in a nucleus as well as the charge exchange scattering cross section are estimated. (auth)

24683 (JINR-P-889) POVERKHNOST OSOBYKH TOCHEK DIAGRAMMY FEINMANA. (Surface of Special Points of Feynman's Diagram). A. A. Logunov, I. T. Todorov, and N. A. Chernikov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 29p.

An explicit expression for the quadratic form of an arbitrary Feynman graph was found in terms of its incidence matrix. Using this expression, the parametric equations for the surface of proper singularities of the graph in the complex space were obtained. The applications of these equations to several graphs are considered. (auth)

24684 (JINR-P-920) N-P-RASSEYANIE PRI ENERGII NEITRONOV 200 Mev. (On the n-p Scattering of 200 Mev Neutrons). Yu. M. Kazarinov and Yu. N. Simonov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 11p.

Total and differential cross sections for (n-p) scattering at 200 Mev were measured. The total cross section is

Results are given of the ratio of the number of positively charged to negatively charged muons in the vertical cosmic radiation at Durham (200 ft above sea level) in the momentum range 5 to 1000 Bev/c. Comparison of the data with other results shows that there is general agreement up to about 20 Bev/c. Two cases are considered in which the measured charge ratio can be used to give information on the nature of the interactions in which the parents of the muons are produced. The cases are: that the majority of muons come from pions which are generated directly in the interactions of the primary cosmic rays (or their secondaries), and that an intermediate hyperon plays a predominant part at high momenta. It is concluded that the present measurements of the charge ratio of muons at sea level are consistent with a pion source in which the fluctuations increase with energy. The results are inconsistent, however, with the predictions of a hyperon model previously proposed. (P.C.H.)

24670 ON THE METHODS GENERALLY USED TO COMPENSATE THE ATMOSPHERIC EFFECTS OF THE MUON COMPONENT OF THE COSMIC RADIATION. T. Sándor, A. Somogyi, and F. Telbisz (Central Research Inst. of Physics, Budapest). Nuovo cimento (10), 23: 1080-8(Mar. 16, 1962). (In English)

On the basis of the muon intensity observed from 1958 to 1960 at a depth of 40 mwe, methods used for correcting the atmospheric effects of the muon component are compared. One method is found that gives a significantly smaller residual mean square deviation than others. The observed muon intensity shows a strong negative correlation with the height of the 200-mb isobaric level, and a negative correlation is also found with the temperature of the stratosphere. (auth)

24671 THE ACCELERATION OF PARTICLES IN THE OUTER ATMOSPHERE. Tatsuzo Obayashi (Hiraiso Radio Wave Observatory Radio Research Lab., Japan). Rept. Ionosphere Space Research Japan, 13: 123-5(1959).

A theoretical mechanism to explain the presence of high energy particles in the outer atmosphere is presented. It is maintained that the energetic particles are being produced in the Earth's outer atmosphere rather than that they are injected from the outside or trapped by the geomagnetic field. It is concluded that the hydromagnetic oscillations in the outer atmosphere are responsible for producing the high intensity flux of energetic particles surrounding the Earth. (Meteorol. Geoastrophys. Abstr., 13, No. 1, Jan. 1962)

24672 IRON METEORITES AS SPACE PROBES FOR THE INVESTIGATION OF THE INTENSITY VARIATIONS OF COSMIC RADIATION DURING THE LAST MILLION YEARS. H. Voshage (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 17a: 422-32(May 1962). (In German)

The use of iron meteorites for the establishment of possible long-time variations (10^8 to 10^9 years) of the cosmic ray intensity in interplanetary space is based upon the study of the production rates of nuclides which are formed by the interaction of cosmic ray particles with nuclei in meteorites. Mass spectrometric measurements of the isotopic composition of meteoritic potassium were combined with data on cosmogenic rare gases and other elements to give K^{41}–K^{40}-exposure ages and rare gas production rates. The K^{41}–K^{40}-exposure ages are larger than the exposure ages obtained from the study of short-lived activities (e.g., Cl^{36}, A^{39}), by a factor 1.3 to 1.8. This result indicates that the cosmic ray intensity increased during the bombardment history of the meteorites. The data are consistent with the following assumptions: the cosmic ray intensity was constant during most of the bombarding time and increased by a factor of about 1.5 only a few million years ago; and the intensity rose as $I(t) = I_0 e^{-\gamma t}$ with $-1.1 \cdot 10^{-9} \leq \gamma \leq -0.6 \cdot 10^{-9}$ a^{-1}. The consequences of this result for the interpretation of meteorite data are discussed. (auth)

24673 COSMIC RAYS. International Geophysical Year and Cooperation in Czechoslovakia, 1957-1959. Václav Petržílka. Prague, Czechoslovakia Academy of Sciences, 1960. 14p.

During the IGY and IGC valuable experimental results were obtained by observing the variations in the penetrating and neutron components of cosmic rays. These results concerned non-periodic disturbances particularly of the Forbush type, and it is expected that numerical evaluation of the experimental data will provide further information on 1-day and 27-day variations, particularly of the neutron component of cosmic rays. Some of the data obtained are given. (Meteorol. Geoastrophys. Abstr., 13, No. 2, Feb. 1962)

Criticality Studies

24674 (ORNL-TM-230) SUPER-PROMPT-CRITICAL BEHAVIOR OF AN UNMODERATED UNREFLECTED URANIUM–MOLYBDENUM ALLOY ASSEMBLY. J. T. Mihalczo (Oak Ridge National Lab., Tenn.). May 10, 1962. Contract [W-7405-eng-26]. 32p.

The time-dependent behavior was investigated of the neutron population in an unreflected unmoderated cylindrical assembly of 90 wt.% U (93.2 wt.% U^{235}), 10 wt.% Mo alloy following rapid establishment of a super-prompt critical condition with negligible initial neutron population. Reactivity increases up to 11 cents above prompt critical resulted in bursts yielding as many as 1.8×10^{17} fissions with reactor periods as short as 16 μsec and temperature increases as large as 400°C. Pressure waves generated in a portion of the core held in position by an electromagnet for bursts greater than $\sim 6 \times 10^{16}$ fissions initiated the removal of this section about 225 μsec after the peak burst. (auth)

Elementary Particles and Radiations

24675 (AFOSR-2637) A MODEL OF THE PIONIC DECAYS OF Σ-HYPERONS. Physics Department Technical Report No. 252. S. Y. Shieh (Maryland. Univ., College Park). Apr. 1962. Contract AF49(638)-24. 12p.

An investigation was conducted to correlate questions such as those concerning the (ΣΛ) relative parity, the relative sign of the asymmetry parameters $\alpha^0\Sigma \rightarrow p + \pi$ and $\alpha\Lambda \rightarrow N + \pi$, and the ratio of the strong coupling constants $G_{\Sigma\Sigma\pi}$, $G_{\Sigma\Lambda\pi}$, and $GNN\pi$ in the problem of pionic decays by assuming that Σ-hyperons first transform themselves to Λ-hyperons by strong interactions then decay through ΛNπ-weak vortex. (J.R.D.)

24676 (APED-3960) DIFFUSION OF CHARGED PARTICLES IN A SCATTERING MEDIUM. Edwin Blue, John H. Ingold, and W. J. Ozeroff (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). May 1962. 10p.

The diffusion approximation of the more exact transport theory is described and used to calculate the potential and electron density distributions for a simple case. In this simple case, electrons are emitted from a plane source

and flow to a plane collector through the scattering gas under the influence of a density gradient and electric fields due to a combination of space charge fields and externally applied fields. The resultant current-voltage relation involves Bessel functions of order one-third. However, a plot of ln J versus ln V_a, where J is the electric current density and V_a the applied voltage, has a slope which varies from one to two, according to whether the major component of the electric current is the density gradient or the electric field, respectively. These results are compared to those reported earlier in the literature. (auth)

24677 (CEA-2136) CONTRIBUTION A L'ÉTUDE DES RÉACTIONS $\pi^- + p \rightarrow \pi^0 + n$ et $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ AUX ÉNERGIES DES MAXIMA DE LA SECTION EFFICACE TOTALE DE L'INTERACTION π^- NUCLÉON DANS L'ÉTAT DE SPIN ISOBARIQUE $T = \frac{1}{2}$ (THÈSES). (Contribution to the Study of $\pi^- + p \rightarrow \pi^0 + n$ and $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ Reactions at the Energies of the Maxima of the π^--Nucleon Interaction in the $T = \frac{1}{2}$ State Total Cross Section (thesis)). René Turlay (France. Commissariat à l'Energie Atomique, Centre d'Etudes Nucléaires, Saclay). 1962. 71p.

Submitted to Université, Paris.

The total cross sections for processes yielding only neutral particles from 300 to 1600 Mev were determined. For this, the number of incident π^- was counted, which interact in a liquid-hydrogen target without giving charged particles in a 4 π counter surrounding the target. The reactions $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ between 300 and 1100 Mev were separated. By supposing that only these two reactions were realized by placing lead absorbers between the target and 4 π counter and by comparing the counting rate for neutral events with and without lead. The transmission measured is a function of the average number of photons produced and therefore of the ratio between the two neutral channels, $\pi^0 + n$ and $\pi^0 + \pi^0 + n$. The experimental results are discussed and compared to those obtained in the study of photoproduction and the π^- nucleon interaction. (auth)

24678 (GEMP-113) PROGRAM 20-2, A PROGRAM FOR APPROXIMATING CROSS SECTION DEPENDENCE ON ENERGY. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962.

Auxiliary nuclear data program 20-2, GE-NMPO program 481, is a digital computer program that approximates cross section dependence on energy by discontinuous straight line segments across specified energy groups. Output from the program is available on punched cards suitable for input to Monte Carlo programs 18-0, FMC-N, and FMC-G. A printed listing of output is also prepared by the program. Program 20-2 is coded for use on an IBM 7090 having 32,768 magnetic core storage locations. (auth)

24679 (GEMP-115) PROGRAM 20-4, A PROGRAM FOR AVERAGING DIFFERENTIAL SCATTERING CROSS SECTIONS. J. P. Yalch and J. E. MacDonald (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 1962. Contract AT(40-1)-2847. 39p.

Auxiliary nuclear data program 20-4, GE-NMPO program 483, is a digital computer program that computes angular distribution data by averaging differential scattering cross sections over specified energy groups. Output from the program is available on punched cards suitable for input to Monte Carlo programs 18-0, FMC-N, and FMC-G. A printed listing of output is also prepared by the program. Program 20-4 is coded for use on an IBM 7090 having 32,768 magnetic core memory locations. (auth)

24680 (ISS-61/41) CINEMATICA DELLA FOTOPRODUZIONE IN INDROGENO DEL MESONE ω^0 CON MASSA DI 787 Mev. (Kinematics of the Photoproduction in Hydrogen of the ω^0 Meson with Mass of 787 Mev). G. Cortellessa and A. Reale (Italy. Istituto Superiore di Sanita, Rome). Sept. 30, 1961. 19p.

Computer values are tabularly presented for the photoproduction of mesons (ω^0) from hydrogen. The 787 Mev mesons (ω^0) are produced from the following reaction: $\gamma + p \rightarrow p + \omega^0$. (N.W.R.)

24681 (JINR-D-976) HYPERCHARGE AND DEGENERACY IN RESPECT TO ISOTOPIC SPIN. A. M. Baldin and A. A. Komar (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 5p.

A type of symmetry is proposed in which systems and particles with hypercharge equal to zero have no dependence on isotopic spin value. Application of this symmetry gives predictions of new particles, quantum numbers of these particles, and relations between cross sections (for example, equality of cross sections of $\tilde{n}$,p and $\tilde{p}$,p interactions). (auth)

24682 (JINR-P-868) VZAIMODEISTVIE OTRITSATEL'NYKH π-MEZONOV S GELIEM PRI ENERGII 153 Mev. (Interaction of Negative π-Mesons with Helium at an Energy of 153 Mev). Yu. A. Budagov, P. F. Ermolov, E. A. Kushnirenko, and V. I. Moskalev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 32p.

The 153-Mev π^- interaction with He^4 nuclei was investigated using the high pressure diffusion cloud chamber operated in the magnetic field. The total cross section for π^--He interaction, elastic scattering cross section, and cross section for a number of inelastic processes were determined by measuring the total length of the π^- meson tracks in the chamber. The angular distribution of elastic π^--He scattering has a diffraction character, the first minimum being 80° and the second maximum 100°. The optical model calculations of elastic scattering with the square well complex potential $V = V_R + iV_I$ have shown that the best agreement with the experimental data can be obtained for the values of the parameters $V_R = -(18 \pm 7)$ Mev, $V_I = -(63 \pm 6)$ Mev, and $r_0 = 1.5 \times 10^{-13}$ cm. These values are consistent with those calculated by Frank, Gammel, and Watson from the relation connecting the optical potential with the forward scattering amplitude for free π-p scattering. The angular distribution of the quasi-elastic π^- meson scattering on the bound nucleons is compared with Watson's and Zemach's calculations. The probabilities of the multiple π^- meson scattering in a nucleus as well as the charge exchange scattering cross section are estimated. (auth)

24683 (JINR-P-889) POVERKHNOST OSOBYKH TOCHEK DIAGRAMMY FEINMANA. (Surface of Special Points of Feynman's Diagram). A. A. Logunov, I. T. Todorov, and N. A. Chernikov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 29p.

An explicit expression for the quadratic form of an arbitrary Feynman graph was found in terms of its incidence matrix. Using this expression, the parametric equations for the surface of proper singularities of the graph in the complex space were obtained. The applications of these equations to several graphs are considered. (auth)

24684 (JINR-P-920) N-P-RASSEYANIE PRI ENERGII NEITRONOV 200 Mev. (On the n-p Scattering of 200 Mev Neutrons). Yu. M. Kazarinov and Yu. N. Simonov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 11p.

Total and differential cross sections for (n-p) scattering at 200 Mev were measured. The total cross section is

$\sigma_t = (42.7 \pm 0.9) \times 10^{-27}$ cm^2. The $\sigma(\theta)$ (center of inertia) is noticeably asymmetric in relation to the $\theta = 90°$ angle. The constant of n-p interaction, found by the angular distribution, is $f^2 = 0.08 \pm 0.02$. (tr-auth)

24685 (JINR-P-928) O PEREZARYADKE π^- MEZONOV S ENERGIEI 7-8 Bev NA PROTONAKH. (On the Charge Exchange of 7 to 8 Bev π^- Mesons by Protons). R. A. Aripov, V. G. Grishin, L. V. Sil'vestrov, and V. N. Strel'tsov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1962. 7p.

Neutral pion production in the reactions $\pi^- + p \rightarrow m\pi^0 + n$ (m = 1,2,3...) was investigated at the momentum of negative pions of 7 to 8 Bev/c. The average number of neutral pions per interaction was found to be 2.8 ± 0.2. The angular distribution of γ-quanta in the cms is anisotropic and has the maximum in the forward direction. The upper limit of the charge exchange cross section was estimated to be $\sigma(\pi^- + p \rightarrow \pi^0 + n) \leq 0.2$ mb. (auth)

24686 (JINR-P-939) O KOORDINATE N'YUTOONA-VIGNERA GLYA SKALYARNOI CHASTITSY. (On Newton-Wigner Coordinate for Scalar Particle). M. I. Shirokov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 7p.

Newton and Wigner obtained a noncovariant coordinate, q, of the scalar particle on the basis of some postulates. It is shown that the ordinary coordinate, x, satisfies all physical and mathematical requirements underlying their postulates if the definition of the probability density in the x-space is used. Therefore, from the point of view of these requirements, the coordinate x is in no way inferior to the coordinate q. (auth)

24687 (JINR-P-944) FAZOVYI ANALIZ NUKLON-NUKLONNOGO RASSEYANIYA PRI ENERGII 310 Mev. (Phase Analysis of Nucleon-Nucleon Scattering at 310 Mev). Yu. M. Kazarinov and I. N. Silin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 18p.

A combined phase-shift analysis of (np) and (pp) data was made. Two sets of the phase shifts are selected from the solutions. When extrapolated over the energy up to 310 Mev, they correspond to sets 1 and 2 obtained by Stapp et al, in the phase shift analysis of p-p data at 310 Mev. (auth)

24688 (JINR-P-947) UPRUYOE RASSEYANIE NEITRINO I ANTINEITRINO NA ELEKTRONE S UCHETOM VYSSHIKH PRIBLIZHENII. (An Analysis of Elastic Neutrino and Antineutrino Scattering by an Electron Considering Higher Approximations). Nguyen Van-hiew (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 10p.

Using the dispersion relation, elastic neutrino and antineutrino scattering by an electron was treated with only the interaction of $(\nu e)(e\nu)$ type which satisfies $(1 + \gamma_5)$ invariance. In the two-body approximation the Low integral equation, whose solution depends on the two constants, is obtained from the dispersion relation and the unitarity. One of these constants is determined by the universal weak interaction constant. The result shows that in the approximation there exists a resonance whose location and half-width depend on an unknown constant. When the energy is tending to infinity the cross section of the processes in question is vanishing. (auth)

24689 (JINR-P-948) OBNARUZHENIE PEREZARYADKI OSTANOVIVSHIKHSYA π-MEZONOV NA YADRAKH SVYAZANNOGO VODORODA. (Detection of Charge Exchange in π-Mesons Stopped in Bound Hydrogen Nuclei). A. F. Dunaitsev, V. I. Petrukhin, Yu. D. Prokoshkin, and V. I. Rykalin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 5p.

Meson π^- charge exchange in polyethylene was evaluated with a high-frequency spectrometer monitoring a 75-Mev π^- beam (passing through a system of scintillation counters and bremsstrahlung filters). Cherenkov spectrometers insensitive to background radiation were used for measuring π^0 decay γ quanta produced by stopped π^-. The ratio of π^0 production in hydrogen and polyethylene was $W_{H_2}/W_{CH_2} = 290 \pm 40$. The statistical order of accuracy was over 5%. The magnitude W_{H_2}/W_{CH_2} in π^- charge exchange in polyethylene is characterized by intense π^- capture by hydrogen nuclei. (R.V.J.)

24690 (JINR-P-966) OKOLOPOROGOVYE OSOBENNOSTI V OBMENNOM PION-NUKLONNOM RASSEYANII. (Threshold Anomalies in Exchange Pion-Nucleon Scattering). L. I. Lapidus (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 9p.

Threshold anomalies in exchange pion–nucleon forward scattering are treated by the method of dispersion relations. The values of the energy widths of threshold anomalies were obtained. It is shown that the experimental investigation of forward exchange scattering with good accuracy can serve as a sensitive method of studying threshold energy cusps connected with new particles in the total cross section of both negative and positive pion interaction with protons. (auth)

24691 (JINR-P-968) PROVERKA SOKHRANENIYA VEKTORNOGO TOKA. (Conserved Vector Current Hypothesis). A. F. Dunaitsev, V. I. Petrukhin, Yu. D. Prokoshkin, and V. I. Rykalin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 6p.

The probability of pion β decay was measured: $\omega(\pi^+ \rightarrow \pi^0 + e^+ + \nu)/\omega(\pi^+ \rightarrow \mu^+ + \nu) = (1.1^{+1.0}_{-0.5}) \times 10^{-8}$. The constant, G, which determines the intensity of this decay, was obtained to be $(1.6 \pm 0.5) \times 10^{-49}$ erg cm^3 which is in agreement with the conserved vector current hypothesis. (auth)

24692 (JINR-P-970) FAZOVYI ANALIZ NUKLON-NUKLONNOGO RASSEYANIYA PRI ENERGII 40, 95, 147, 310 Mev. (Phase Analysis of Nucleon-Nucleon Scatter at 40, 95, 147, and 310 Mev). Yu. M. Kazarinov and I. N. Silin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems and Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 17p.

A combined phase shift analysis of np and pp scattering is made. The sets of the phase shifts obtained are given. The pion-nucleon interaction constant is 0.08. The pion mass from the nucleon-nucleon scattering data is evaluated. The value obtained for the mass does not contradict the well unknown one. (auth)

24693 (NP-11538) MEASUREMENTS OF CONTINUOUS ENERGY DISTRIBUTIONS OF GAMMA RAYS IN A SCATTERING MEDIUM (thesis). Christiaan Sybesma (Delft, Netherlands. Technische Hogeschool). 1961. 98p.

Studies were made of multiple scattering in penetration problems. Measurements were made of continuous photon energy distributions, resulting from scattering of gamma rays in a water medium, with a single-channel scintillation spectrometer. The geometry chosen was such that the measuring conditions were comparable with conditions found in radiological applications. Cs^{137} was used as the gamma source. A general formulation of the penetration problems and a summary of publications on this subject are given. Measurements of pulse height distributions in a bounded water medium are described. The difficulties in the correction of the measured pulse height distributions

are discussed. A solution of the problems concerning the spread in the pulse height is proposed. The correction of the energy escape effects in the scintillation crystal is discussed. These corrections were applied to the pulse-height distribution measurements and the resulting photon energy distributions and buildup factors are discussed. The possibility of applying the described measuring and correction method to measurements with other geometries is outlined. (M.C.G.)

24694 (NP-11731) A DOUBLET SCHEME FOR THE LEPTONS. C. Ryan (Dublin. University Coll. and Dublin Inst. for Advanced Studies). Apr. 16, 1962. 11p.

A scheme in which the leptons are paired in two doublets is proposed on the assumption that there exist two distinct neutrinos. It is shown that a simplification of the strangeness conserving weak interactions ensues. Some consequences of the gage invariance principle of elementary particle interactions are discussed. (auth)

24695 (NP-11757) ROZHDENIE π^0 MEZONOV V KULONOVOM POLE YADRA. (The π^0-Production in the Coulomb Nuclear Field). V. V. Barmin, Ju. S. Krestnikov, E. V. Kuznetsov, A. G. Meshkovskii, Ju. P. Nikitin, and V. A. Shebanov (Akademiya Nauk S.S.S.R. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1962. 24p.

π^0 production by 2.8 Bev/c π^- mesons in the Coulomb field of the xenon nucleus by the reaction $\pi^- + Xe \rightarrow \pi^- + \pi^0 + Xe$ was investigated in a xenon bubble chamber. The cross section of this reaction for scattering angles Θ of π^- in the interval 3 to 30° was found to be $\sigma_c = (4.4 \pm 1.6)$mb. The angular distribution of negative pions has a sharp peak at $\Theta < 10°$. A relation between the cross section σ_c and the cross section of the photoproduction process $\gamma + \pi^- \rightarrow \pi^- + \pi^0$ was derived. The mean cross section of this reaction calculated from this relation was found to be (0.6 ± 0.2)mb in the interval $4m^2 \leq w^2 \leq 21m^2$. (auth)

24696 (NP-11880) THE ROLE OF FOCUSING ČERENKOV COUNTERS IN HIGH ENERGY PHYSICS. Technical Report No. 31. Sherman K. Poultney (Princeton Univ., N. J. Palmer Physical Lab. and Princeton Univ., N. J. Naval Ordnance Lab.). June 30, 1962. Contract Nonr-1858(06). 73p.

A perspective of the role of focusing Cherenkov counters in high energy physics is given. The excellent time resolution and good velocity resolution of these counters are discussed. The basic principles of their operation and the limitations to their velocity resolution are considered in detail. Several designs for differential gas Cherenkov counters are given. These designs provide incident beams of identified particles up to $\gamma = 100$ and 200 for use in experiments such as the measurement of total cross sections. One key element of the Cherenkov chamber, the image intensifier chain, is evaluated in an analogous experimental situation. The velocity resolution is especially important above $\gamma = 10$ where other methods cannot as yet be used to identify particles. The present restriction to a counting rate of one event per beam pulse, the small field of view, and the need to identify a particle under observation, however, will considerably limit the use of the Cherenkov chamber. (auth)

24697 (NYO-10132) 7070 PROGRAM FOR A MONTE-CARLO CALCULATION OF A NUCLEAR CASCADE. Suresh Thakore, A. C. Melissinos, and J. Tinlot (Rochester. Univ., N. Y.). [nd]. Contract [AT(30-1)-875]. 15p.

A 7070 program was written and used for preliminary Monte Carlo calculations of the development of a nuclear cascade. Two typical sets of parameters were used for testing the program, and results were satisfactory. (M.C.G.)

24698 (RAI-201) THE DEVELOPMENT OF LARGE FISSION PRODUCT BETA SOURCES. Quarterly Report, January 1 to March 31, 1962. Jacques J. Weinstock, Ella Y. Mirocznik, and P. Murali Krishna (Radiation Applications, Inc., Long Island City, N. Y.). May 23, 1962. Contract AT(30-1)-2186. 25p.

The addition of Cs_2O to cerium enamel was found to improve its acid resistance. The addition of small amounts of iron oxide (1 to 3%) or nickel oxide to strontium enamels did not change their acid resistance. The addition of 5% of iron oxide lowered the enamels' resistance to acid attack, while 3% of chromium oxide improved their acid resistance. An oxidizing furnace atmosphere must be used to obtain strontium enamels with a high acid resistance. The addition of small quantities of metal oxides to strontium enamels, did not appreciably affect their mechanical impact strength. The addition of 3% iron oxide, however, did change the type of failure on impact to cohesive (within the enamel coating) rather than adhesive (failure at the metal-enamel interface). The elimination of all water and hydroxyl ions from a cerium enamel formulation did not change the final enamel properties as checked by resistance to acid. Preliminary impact test results on large panels were significantly greater than those for smaller samples of equal enamel thickness. A study of the effect of a high humidity atmosphere and an acidic atmosphere on enameled stainless steel samples is in progress. Leach test data are presented for Pm^{147} enamel in water, 0.1N NaOH, 0.01N HCl, 0.1N HCl, and buffer solution (pH 4) at ambient temperatures, and also in water near the boiling point. The highest leach rates are observed for hot water, reaching 55 ppm per day after 50 days, while all other rates are in the range of 0 to 3 ppm per day. Experimental and theoretical dosimetry data are given and compared for enameled Pm^{147} sources. (auth)

24699 (TID-15820) NUCLEAR CHEMISTRY RESEARCH OF HIGH-ENERGY NUCLEAR REACTIONS AT CARNEGIE INSTITUTE OF TECHNOLOGY, 1961–1962. Progress Report. (Carnegie Inst. of Tech., Pittsburgh). June 1, 1962. Contract AT(30-1)-2897. 67p.

Progress in the study of high-energy nuclear reactions and related problems is described. Summaries are given of 11 research projects. (M.C.G.)

24700 (TID-16108) ON THE RADIATIVE CORRECTIONS TO $K \rightarrow e\nu$ AND $K \rightarrow \mu\nu$ DECAYS. N. P. Chang (Columbia Univ., New York). [1959]. Contract AT(30-1)-2086. 15p.

The radiative corrections to the ratio of the $K \rightarrow e\nu$ rates to the $K \rightarrow \mu\nu$ rates were calculated for an experiment where photon counters were used to help discriminate against the K_{e3} background. This was in contrast to the previously calculated case where all photon energies are included in the rate. The theoretical advantage of including only the low-energy photons is emphasized. (auth)

24701 (UCRL-10126) A STUDY OF THE REACTIONS $K^- + p \rightarrow K + N + (\pi)$ AT 1.15 Bev/c (thesis). William Graziano (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 19, 1962. Contract W-7405-Eng-48. 36p.

A study was made of the following $K^- p$ reactions at 1.15 Bev/c: $K^- + p \rightarrow K^- + p$, $K^- + p \rightarrow K^0 + n$, $K^- + p \rightarrow K^- + p + \pi^0$, $K^- + p \rightarrow K^- + n + \pi^+$, and $K^- + p \rightarrow K^0 + n + \pi^0$. Cross sections for each of these reactions and angular distributions for the elastic and charge-exchange scatters are presented. From the analysis of the $K^- + p + \pi^0$ events, the

cross section for the reaction $K^- + p \rightarrow K^{*-} + p$, with the K^{*-} decaying into $K^- + \pi^0$ was obtained. Combining this cross section with that for $K^- + p \rightarrow K^{*-} + p$ followed by $K^{*-} \rightarrow \overline{K^3} + \pi^-$, a value of 0.5 ± 0.2 was found for the branching ratio, $(K^{*-} \rightarrow K^- + \pi^0)/(K^{*-} \rightarrow \overline{K^3} + \pi^-)$. This value substantiates the earlier preliminary result of isotopic spin ½ for the K^* resonance. (auth)

24702 DETERMINATION OF THE MULTIPLE SCATTERING OF CHARGED PARTICLES IN NUCLEAR EMULSIONS. Brigitte Dépaux. Ann. phys., 6: 1335-78(Nov.-Dec. 1961). (In French)

As an introduction to the determination of the multiple scattering of charged particles the different methods used for the measurement are reviewed. The emulsion method was used for study at both high and low energies. The tangent method was used to study the multiple scattering of π mesons coming to rest in emulsions. The background was eliminated and the multiple diffusion constant was determined and compared with theory. In the study of high-energy particles, protons of 2.1 and 6.2 Bev, an attempt was made to reduce or eliminate errors such as background and parasitic scattering. The surface method and the center-of-gravity method were applied to the study, and the results were compared. Ilford G5 emulsions were used; they were developed by the usual method with no special precautions. (J.S.R.)

24703 CONTRIBUTION TO THE STUDY OF RESONANT SCATTERING OF BREMSSTRAHLUNG PHOTONS. André Bussière de Nercy. Ann. phys., 6: 1379-1436(Nov.-Dec. 1961). (In French)

24704 LOW-ENERGY K^--NUCLEON SCATTERING AND ODD ($\Sigma\Lambda$) PARITY. Matts Roos (Univ. of Stockholm). Arkiv Fysik, 20: 539-41(1962). (In English)

It is suggested that examination of the K^--p elastic scattering cross sections at momenta down to 62 Mev/c, and at large scattering angles, might be used to make a choice between the (a+) and (a–) solutions predicted for the cross sections by the zero-effective-range theory. It is noted, however, that in order to make any theoretical conclusions regarding the cross sections below 172 Mev/c the $\Sigma\Lambda$ parity must be known. Under the assumption of odd $\Sigma\Lambda$ parity, the (a+) and (a–) solutions are compared as functions of scattering angle and of momentum from 62 to 172 Mev/c. At 62 Mev/c the (a+) solutions for even and odd $\Sigma\Lambda$ parity are compared and shown to differ. (T.F.H.)

24705 PRODUCTION OF "PURE" FAST-NEUTRON FLUXES IN THE IRT-100 REACTOR FOR RADIOLOGICAL STUDIES. Yu. I. Bregadze, B. M. Isaev, V. A. Kvasov, B. A. Levin, and Yu. F. Chernilin. Atomnaya Energ., 12: 537-8(June 1962). (In Russian)

The design of devices for obtaining "pure" fast-neutron fluxes, free from associated γ-rays in a sufficiently broad dose range presents structural difficulties; such devices are however greatly needed for irradiating biological specimens. For this reason an experimental assembly was built in the 100-mm diameter horizontal beamhole of the IRT-100 reactor. Filters consisting of 100-mm thick Bi and a 2.4 g/cm^2 B carbide layer were placed at a distance of 184 cm from the external opening of the beamhole, while two 70-mm thick graphite reflector assemblies with their center portions removed were located at the beginning of the beamhole. This resulted in an increase of the fast neutron flux by a factor of 1.7 without a corresponding increase of the γ dose. Polystyrene, polyethylene, and graphite ionization chambers were placed at various points of the reactor for measuring the absorbed fast neutron and γ doses, D_n and D_γ. The D_n/D_γ ratio was found to vary between 2.6 and 10.9, depending on the distance from the filter. (TTT)

24706 PRECISION MEASUREMENTS OF THE (n,p) TOTAL CROSS SECTION IN THE VAN DE GRAAFF ENERGY REGION. Charles Edward Engelke (Columbia Univ., New York). Dissertation Abstr., 22: 3707(Apr. 1962).

The (n,p) total cross section at 0.4926 Mev was measured to be 6.200 barns ± 0.18%. This measurement, when combined with results at zero energy, determines the (n,p) singlet effective range to be $2.32 \pm 0.13 \times 10^{-13}$ cm. The uncertainty was decreased by a factor of 2 from the best previous determination. The systematic uncertainty due to shape dependence effects is less than $\pm 0.04 \times 10^{-13}$ cm. The total (n,p) cross section at 3.200 Mev was measured as 2.209 barns ± 0.31%. This preliminary value was obtained in the process of measuring rate dependence effects to correct the (n,p) cross section at 0.4926 Mev for count rate dependence. This work was initiated because a survey of experimental results on S wave (n,p) scattering indicated that an improvement of a factor of two or more in the accuracy of total cross section measurements in the Van de Graaff energy region could furnish a more precise value of r_0 singlet and also determine experimental values for the shape parameters. The neutron total cross section measurement techniques which have been developed, utilizing resonant neutron detectors, allow an accuracy better by a factor of 3 than that of any previous workers.

24707 AN EXPERIMENTAL STUDY OF THE DIRECT PRODUCTION OF PI MESONS BY HIGH-ENERGY ELECTRONS. Louis Neff Hand (Stanford Univ., Calif.). Dissertation Abstr., 22: 3707-8(Apr. 1962).

The direct production of pi mesons by high-energy electrons was studied experimentally as an indirect measurement of the charge and magnetic structure of the neutron. The reactions of interest are: $e^- + p^+ \rightarrow e^- + p^+ + \pi^0$ and $e^- + p^+ \rightarrow e^- + n^0 + \pi^+$. Only the final electron is observed. Physically the experiment consists of passing a beam of electrons through a liquid hydrogen target. Electrons scattered at a given angle and having momenta within a certain range about a selected value are analyzed with a magnetic spectrometer and counted by virtue of their Čerenkov light in a counter filled with paraffin oil. This counter has been designed to minimize the background. Counting rates for positive and negative particles are recorded for each momentum setting. The initial and final energies may be programmed to vary either the pion-nucleon dynamics or the invariant four-momentum transfer (q^2) independently. The behavior of the cross section as a function of the latter variable is in part determined by charge and magnetic moment distributions of the proton and neutron and by the charge distribution of the pion. It is unfortunate that the sensitivity of the present experiment to the pion size is rather low, as no published information exists on this quantity. One important difference between electroproduction and the more usual gamma-ray excitation of mesons is the possibility of inducing the above reactions with the electric field possessed by the electron along its direction of motion. A simple proof was found of a theorem which permits a purely experimental determination of the amount of this longitudinal interaction relative to the transverse interaction occurring in both the electron and gamma-ray production of pions. This theorem is applicable to a wide class of electron scattering experiments. The results indicate the absence of any longitudinal pion production in the energy region covered by this experiment. This work represents a continuation and extension of two previous experiments done at Stanford. An unsuccessful

search was made at high energies for effects of the so-called "second resonance" in the pion-nucleon interaction. Several experimental checks were made on the validity of this method of data analysis, which requires an accurate theoretical calculation of the principal background: $e^- + p^+ \rightarrow e^- + p^+ + \gamma$, i.e., the emission of a high-energy gamma ray accompanied by scattering of the electron to a large angle. Analysis of the data proceeds by taking the pion-nucleon phase shifts as given and varying the neutron structure factors for a best fit (minimum χ^2) at a fixed q^2 using the elastic scattering results on the proton structure to reduce the number of variables. This is done on a digital computer. The results are compared briefly with those obtained by the inelastic electron scattering from deuterium.

24708 TWO-NUCLEON SCATTERING USING VELOCITY-DEPENDENT INTERACTIONS. Onofre Rojo-Asenjo (Louisiana State Univ., Baton Rouge). Dissertation Abstr., 22: 3709-10(Apr. 1962).

The problem of two-nucleon scattering is solved assuming a well-behaved interaction which consists of a static attractive part and a velocity-dependent part depending on the square of momentum. The form of the potential used is: $v = V(r) + (1/M)(p^2\omega(r) + \omega(r)p^2)$. With this potential, Schrödinger equation is solved numerically for different sets of values of $\omega(r)$ and $V(r)$. The values of the ^1S and ^1D phase shifts for energies from 20 to 340 Mev are compared with Breit's values. The results are in good agreement for the ^1S phase shifts, but for ^1D the fit varies from poor to fair for the potentials used. The Born approximation using an "effective potential" is used to calculate ^1S and ^1D phase shifts at 310 Mev. Results are in good agreement with the ones obtained numerically. To compare a velocity-dependent potential and a static potential with a core, a velocity-dependent potential of the form $v = -V_0 J_1(r) - (\lambda/M)p \cdot J_2(r)p$ is used. With $J_1(r)$ and $J_2(r)$ square wells, the analytical solution is found and the integrated cross section is calculated for deuteron photoeffect. A static square well is compared with an infinite repulsive core. It was found that both potentials give very similar integrated cross sections.

24709 I. THEORETICAL ANALYSIS OF ELECTRON PRODUCTION OF SINGLE PIONS AND PHOTONS. II. DISPERSION THEORETICAL ANALYSIS OF THE ELECTRON'S MAGNETIC MOMENT. Clyde Nimmer Lindner (Stanford Univ., Calif.). Dissertation Abstr., 22: 4374 (June 1962).

This dissertation includes (a) a theoretical review of the pion production by electrons and its subsequent application to the study of nucleon structure, and (b) a theoretical analysis of the bremsstrahlung process with regard to its supplementary role in the analysis of (a), as well as other applications. In addition, the electron itself can be studied. Modification of the theory by the addition of finite size distributions for the electron's charge and current, as expressed by additional form factors, would affect the purely electrodynamic bremsstrahlung process. The analysis is thus applied also to a study of the limitations on quantum electrodynamics inherent in this process (c). Limiting the consideration to proton targets, three processes are of interest: the bremsstrahlung process: $e + p \rightarrow e + p + \gamma$ and the single pion production processes: $e + p \rightarrow e + p + \pi^0$ and $e + p \rightarrow e + n + \pi^+$. The particular structure of the nucleons is the spatial distribution of its electric charge e and magnetic moment $\vec{\mu}$, essentially defined by their interactions with the electrostatic potential ϕ and magnetic field $\vec{B}$. Interaction energy = $e_0 \int \rho_e(r-r'')\,\bar{\phi}(r')\,d^3\sigma' + \mu_0 \int \rho_m(r-r')\,\vec{B}(r')\,d^3r'$. A relativistic covariant extension of these quantities in four dimensional space-time is incorporated within the traditional framework of the theory. The observable scattering processes yield information not about the charge and magnetic moment distributions themselves, but rather their Fourier transforms or form factors. Consideration is given to some of the mutual kinematic features of the bremsstrahlung and pion production processes. Emphasis is placed on the observation of the electron, since inelastic electron scattering at large angles yields the most useful information about nucleon structure. A dispersion theoretical treatment of the pion production cross section has been carried out and is applied, along with supplementary information from other processes, to yield neutron structure information. The inelastic bremsstrahlung process has been studied extensively in earlier work by other authors, usually based on a point charge interaction for the proton. The modifications introduced in this calculation include: (a) Consideration of the proton's magnetic moment. (b) Consideration of the finite size of the charge and magnetic moment distributions of the proton. (c) Radiation from the proton, as well as the electron (in particular their interference), within certain degrees of approximation. (d) Complete relativistic covariance in lowest order perturbation theory in all parts of the calculation. Electrodynamic corrections of order $\alpha = 1/137$ smaller have been studied elsewhere and are only briefly mentioned. A criticism is made of the form factor analysis with regard to the proton radiation along with the potentially large mesonic corrections. All considerations have assumed a point charge interaction for the electron. The sensitivity of the observations to an electron interaction vertex of finite size is given brief numerical consideration. Finally the theoretical treatment of the electron vertex is considered mainly as a pedagogical comparison of the dispersion-theoretical and perturbation-theoretical methods of calculation.

24710 AN INVESTIGATION OF THE ELASTIC SCATTERING OF Λ HYPERONS FROM PROTONS. Thomas Hoopes Groves (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 4379(June 1962).

An investigation was made into the elastic scattering of Λ hyperons from protons. The particle interactions were photographed in a propane bubble chamber. The Λ hyperons were produced by the interactions of 1.15 Bev/c K^- mesons in the propane. Some 14,000 Λ decays were observed with Λ momenta distributed from 150 to 1500 Mev/c in the laboratory co-ordinate system. Thirty-one examples of the elastic scattering process $\Lambda + p \rightarrow \Lambda + p$ were found. Based on these figures, the elastic scattering cross section is estimated to be 20.0 ± 4.9 mb. Corrections for bubble chamber geometry and contamination from carbon interactions are introduced in the calculation of the cross section. The results of this experiment are compared with existing experimental data and several theoretical predictions. The data are shown to be in good agreement with the previous experimental investigations. The data agree satisfactorily with the theoretical predictions but are not numerous enough to provide a basis for judging the relative merits of the individual predictions.

24711 FINAL STATE INTERACTION IN STRANGE PARTICLE PRODUCTION. Justin Chi Ching Huang (Michigan State Univ., East Lansing). Dissertation Abstr., 22: 4379(June 1962).

Phenomenological methods were employed in hopes of explaining the experimental results to the reaction $\pi^- +$

$p \rightarrow K + Y + \pi$. The theory of final state interactions as formulated by Watson was applied to the consideration of two different assumptions concerning the above reaction. These are: A. Neglecting the K-Y and the K-π interactions, what are the implications of global symmetry in the final state π-Y interaction? B. What information can one obtain concerning the π-K interaction by neglecting the π-Y and K-Y interactions and consider only the K-π interaction in the final state? For both parts A and B, Fermi's statistical model was used to determine the matrix elements for the primary interaction. For part A, the secondary interaction was treated using the P-wave effective range formula where the arbitrary parameters were fitted to the pion-nucleon $I = {}^1/_2$, $J = {}^3/_2$ resonance data in accordance with global symmetry. The secondary interaction in part B was also handled by the use of effective range formulas where the parameters were fitted to the known experimental full width at half maximum and effective mass for an $I = {}^1/_2$ resonance. Both a S-wave and P-wave resonance were considered. The results for part A indicated that the methods used would not give a very strong test of global symmetry as the results did not differ appreciably from a purely statistical theory calculation. For part B, the results indicated a $K^0\pi^+\Sigma^-/K^+\pi^0\Sigma^-$ ratio of 1.7 with a small amount of $K^0\pi^-\Sigma^+$ reactions for both the S- and P-wave cases. This is in good agreement with the experimental results obtained so far. The calculations also indicated a $K^+\pi^0\Sigma^-/K^0\pi^0\Sigma^0$ ratio of 1.7 for a S-wave resonance and a ratio of 0.7 for a P-wave resonance. Unfortunately, the reaction $K^0\pi^0\Sigma^0$ is difficult to determine experimentally and no experimental results were obtained on them.

24712 THE RHO VALUE FOR THE BETA DECAY OF THE NEGATIVE MUON. Tadashi Kikuchi (Duke Univ., Durham, N. C.). Dissertation Abstr., 22: 4380(June 1962).

The decay spectrum of negative muons was investigated for the μ^- decays found in the Duke Helium Bubble Chamber, operated in a magnetic field of 14,000 gauss. About 50,000 pictures were scanned for μ^- decays, and 4300 of the decays observed were measured. An analysis of 2276 selected events yielded a value for the Michel parameter, ρ, of 0.751 ± 0.034. A statistical analysis of the momentum scale confirmed the accuracy of the experimental assumptions. The ρ value is in good agreement with the most recent results of the decay spectrum of positive muons and confirms the validity of the two component neutrino and universal V-A theories.

24713 DIFFRACTION OF ELECTROMAGNETIC WAVES ON CONDUCTING PLATE IN CONDUCTING SPACE. V. I. Dmitriev (Magnetic Laboratory of the Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Ser. Geol., No. 6, 731-5(June 1962). (In Russian)

The problem of electromagnetic wave diffraction on a finite-conductance plate submerged in a conducting semi-space is reduced to the ordinary Fredholm second-order equation. (R.V.J.)

24714 ELEMENTARY PARTICLES AND PHOTRON THEORY. K. Nowak. Neue Physik, 2: 125-53(1960-1961). (In German)

The properties and interactions of "elementary particles" are discussed, and the present concept of these particles is contrasted with the clarification offered by the photron theory. A new arrangement of the elementary particles is given, and it is shown how their structure and life times can be explained. A review of the difficulties overcome by the photron theory is given. (tr-auth)

24715 INELASTIC π^--NUCLEON INTERACTIONS AT 7 Gev WITH SMALL MULTIPLICITIES. C. Grote, J. Klabuhn, J. Klugow, U. Krekcer, U. Kundt, K. Lanius, and H. W. Meier (Kernphysikalisches Institut der Deutschen Akademie der Wissenshaften, Berlin). Nuclear Phys., 34: 648-58(June 1962). (In English)

Interactions initiated by 7-Bev π^- mesons are studied by emulsion and bubble chamber techniques. With appropriate criteria, 215 inelastic pion-nucleon interactions are selected in the emulsion and 178 in the propane bubble chamber. For events with small multiplicity it is found that for one-prong events, and for two-prong events with a secondary proton, most of the emitted pions have momenta in the cms greater than 0.6 Bev/c. Furthermore their angular distributions in the cms are strongly peaked in the forward direction. Assuming that only one pion is produced in the collisions it is found that only a negligible part of the interactions can proceed via the formation of a nucleon isobar. The kinematical data of the collisions with $\Delta^2 < (2.5\ m_\pi)^2$ are in agreement with those calculated for the process $\pi^- + N \rightarrow N + \pi^*$. The cross section for π^--proton interactions with formation of a $\pi\pi$ isobar is about 1.5 mb. (auth)

24716 EXPERIMENTAL RESULTS ON THE INELASTIC PION-NUCLEON INTERACTIONS AT 7 Gev AND THE FORMATION OF ISOBARIC STATES. C. Grote, J. Klabuhn, U. Krecker, U. Kundt, K. Lanius, and H. W. Meier (Kernphysikalisches Institut der Deutschen Akademie der Wissenschaften, Berlin). Nuclear Phys., 34: 659-75(June 1962). (In English)

In a stack of emulsions irradiated with negative pions, using appropriate criteria, 215 π^--nucleon interactions are identified. In a careful investigation of the proton momentum distribution the existence of two maxima was established. The corresponding distribution of the inelasticities of the pion-nucleon collisions shows also two maxima with the mean values $\overline{K} = 0.30$ and $\overline{K} \approx 0.68$. Differences are shown in the momentum and angular distributions of the secondary particles in the groups of interactions with $K \lessgtr 0.5$ and $K > 0.5$. The experimental data agree with the assumption that the collisions of $K \lessgtr 0.5$ could proceed via the formation of isobaric states of the pion and of the nucleon. The cross sections for these reactions are $\lessgtr 11$ mb for π^--proton collisions and $\lessgtr 10$ mb for π^--neutron collisions. The existence of a pronounced peak at 765 Mev in the π^π mass spectrum is established for π^--nucleon interactions with $K \lessgtr 0.5$. (auth)

24717 INELASTIC π^--NUCLEON INTERACTIONS AT 7.5 Gev IN THE EMULSION. C. Grote, J. Klabuhn, U. Krecker, U. Kundt, K. Lanius, and H. W. Meier (Kernphysikalisches Institut der Deutschen Akademie der Wissenshafter, Berlin). Nuclear Phys., 34: 676-84 (June 1962). (In English)

Interactions initiated by 7.5-Bev π^- mesons are studied by an emulsion technique. The mean free path for inelastic collisions of negative pions at 7.5 Bev in emulsion proves to be (38.4 ± 1.0) cm. With appropriate criteria, 215 inelastic pion-nucleon interactions are selected. Out of the secondary tracks 279 are identified. The angular distribution of the emitted pions, their momenta, and transverse momenta are investigated. Interactions with an inelasticity >0.5 may be described by the statistical theory of multiple production. (auth)

24718 INELASTIC π^--NUCLEON INTERACTIONS AT 6.8 Gev IN THE BUBBLE CHAMBER. C. Grote, J. Klugow, U. Krecker, and K. Lanius (Kernphysikalisches Institut der Deutschen Akademie der Wissenshaften, Berlin). Nuclear Phys., 34: 685-93(June 1962). (In English)

Pictures taken from a 24-l propane bubble chamber exposed to negative pions of (6.8 ± 0.6) Bev/c momentum are scanned for inelastic pion-nucleon interactions. A total of 171 inelastic π^--nucleon events is found. The distribution of momenta, angles, and transverse momenta are given. The results are compared with those of inelastic pion-nucleon interactions in nuclear emulsions. It is found that about 20% of the interactions identified in the propane bubble chamber are events which, in nuclear emulsion, would not show up as pion-nucleon collisions. From an investigation of the accidental and systematic errors in the momentum determination it is concluded that distortions in the bubble chamber and on the photographic film cannot be neglected if high momenta are measured. (auth)

24719 MESON PRODUCTION BY 16 Gev/c π^--MESONS IN HYDROGEN. S. J. Goldsack (Univ. of Birmingham, Eng.), L. Riddiford, B. Tallini, et al. Nuovo cimento (10), 23: 941-53(Mar. 16, 1962). (In English)

A study is made of the properties of 250 interactions produced by negative pions at 16 Bev/c in liquid hydrogen in a 30-cm-diameter bubble chamber. (auth)

24720 THE SCATTERING OF 87 Mev POSITIVE PIONS ON CARBON AND OXYGEN. F. P. G. Valckx, E. S. Gelsema, and M. Kruiskamp (Rijksuniversiteit, Utrecht). Nuovo cimento (10), 23: 1005-20(Mar. 16, 1962). (In English)

Elastic and inelastic scattering angular distributions of 87-Mev positive pions on carbon and oxygen are measured with a total-absorption scintillation spectrometer of high energy resolution. The elastic angular-distribution data can be fitted with the Kisslinger theory. The inelastic angular distributions are strongly peaked in the backward direction. The inelastic differential cross section appreciably surpasses the elastic cross section at angles above about 100°. At several angles a peak is seen in the energy spectra of pions scattered from carbon, which must be explained as resulting from quasi-free pion-nucleon scattering. (auth)

24721 ON ELASTIC PION AND NUCLEON SCATTERING AT HIGH ENERGIES. D. I. Blokhintsev (Joint Inst. for Nuclear Research, Moscow). Nuovo cimento (10), 23: 1061-3(Mar. 16, 1962). (In English)

It is shown that under rather general assumptions the large angle elastic scattering cross sections must decrease as $1/E_0$ (E_0 is the energy of an incident particle in the laboratory system). (auth)

24722 MODELS FOR COMPOUND PARTICLES. W. E. Thirring (Universität, Vienna). Nuovo cimento (10), 23: 1064-72(Mar. 16, 1962). (In English)

Some versions of the Zachariasen model are used to describe mesons as bound particles. The resulting coupling constants are discussed and the resonances associated with the bound state are calculated. (auth)

24723 PION-PION SCATTERING IN THE TWO-PION EXCHANGE APPROXIMATION. B. H. Bransden (The University, Glasgow) and J. W. Moffat. Nuovo cimento (10), 23: 1089-98(Mar. 16, 1962). (In English)

A calculation of pion-pion scattering in the two-pion exchange approximation is presented. If S- and P-waves are subtracted and if $t_{max} \lesssim 16$ and $s_{max} \lesssim 1600$ the equations converge. It is found that there is little alteration in the low-energy solutions obtained using Legendre polynomial expansions to determine the left cut. For $t_{max} \lesssim 16$ and $s_{max} > 1600$ certain integrals over the double spectral functions fail to converge. The results for the case where this cutoff is introduced are discussed. (auth)

24724 FORBIDDEN WEAK INTERACTIONS AT VERY HIGH ENERGIES. J. Nilsson (CERN, Geneva). Nuovo cimento (10), 23: 1102-13(Mar. 16, 1962). (In English)

In the study of forbidden (second order) weak interactions, the photoproduction of a μe pair in the Coulomb field of a nucleus is considered. By taking advantage of the coherence effect a total cross section of the order 10^{-38} cm^2 is obtained for 10-Bev photons, assuming the weak interaction cut-off at 50 Bev. The "weak pair production" depends only logarithmically on the energy of the incoming photon in the high-energy limit. Therefore, even a large increase in energy will not increase the cross section substantially. At 300 Bev the total cross section remains as small as 5×10^{-38} cm^2. As a result of the large mass difference between the electron and the μ meson the energy spectrum for the μ meson is very strongly peaked for nearly maximal energy. This characteristic distinguishes the weak pair production from other possible competing processes. Experimentally, this characteristic feature of the energy distribution for the process studied is of importance, and it may enhance the possibilities of observing the process. (auth)

24725 THE q-VALUE FOR THE β-DECAY OF THE NEGATIVE MUON. M. M. Block (Duke Univ., Durham, N. C.), E. Fiorini, T. Kikuchi, G. Giacomelli, and S. Ratti. Nuovo cimento (10), 23: 1114-25(Mar. 16, 1962). (In English)

The decay spectrum of negative muons was investigated in a He bubble chamber, operated in a magnetic field of 14 kOe. About 50,000 pictures were scanned for μ^- decays, and ~5000 decays were observed and measured. An analysis of 2276 selected events yielded a value for the Michel parameter, $q = 0.751 \pm 0.034$. A statistical analysis of the momentum scale confirmed the accuracy of the experimental assumptions. The q value is in agreement with results on the decay spectrum of positive muons and is in accord with the predictions of the two-component neutrino and universal V−A theories. (auth)

24726 INTERNAL ALGEBRA OF BARYONS AND MESONS AND THE STRUCTURE OF STRONG INTERACTIONS. T. Takabayasi (Univ. of Nagoya, Japan). Nuovo cimento (10), 23: 1155-62(Mar. 16, 1962). (In English)

It is hypothesized that all elementary particles possess abstract internal variables of a two-dimensional Bose oscillator and a two-dimensional Fermi oscillator, and these variables are used to define internal quantum numbers for the particles. Restrictions on admissible physical states force the conclusion that only 8 quantum states are physically possible. In order to incorporate these results into field theory, the baryon octet is represented by a Dirac field that depends on the internal quantum numbers and on space-time. Similarly, the mesons are represented by a pseudoscalar field. The formulations of these fields as 8×1 column matrices are shown. These formulations are used in an analysis of the symmetry properties of strong interactions of elementary particles. (T.F.H.)

24727 DIFFUSION WITH CHARGE EXCHANGE. K^+-DEUTERIUM. J. M. Lévy-Leblond (Laboratoire de Physique Théorique et Hautes Energies, Orsay, France) and M. Gourdin. Nuovo cimento (10), 23: 1163-7(Mar. 16, 1962). (In Italian)

Charge-exchange scattering of K^+ mesons on deuterons ($K^+ + d \rightarrow K^0 + p + p$) is analyzed in the isotopic-spin-0 state at 111 to 456 Mev, in the impulse approximation. The Hulthén wave function is assumed for the deuterium, which is supposed to be in the $^3S_1$ state. The only final-state interaction considered is the p-p Coulomb interaction. Within

this framework, the bubble-chamber charge-exchange scattering data are fitted by S-, P-, and D-wave interactions, using five partial-wave amplitudes. (T.F.H.)

24728 REMARK ON THE CONSERVATION OF THE AXIAL VECTOR CURRENT. H. Banerjee (Carnegie Inst. of Tech., Pittsburgh). Nuovo cimento (10), 23: 1168-70 (Mar. 16, 1962). (In English)

The conjecture is considered that: if the axial vector current were conserved in the V – A theory of weak interactions, the absolute values of the Gamow-Teller constant (G_A) and the Fermi constant (G_V) would be exactly equal, and the Goldberger-Treiman relation between G_A and the charged pion decay constant would be valid. It is noted that attempts to verify this conjecture in field theoretical models depend on the assumptions that: there exists a pseudoscalar zero-mass meson that interacts with the nucleon; and that in the limit of zero momentum transfer, a particular form factor must equal unity. It is shown by analysis of the properties of the chirality operator, and by consideration of the conservation of the axial vector current, that this form factor, which is an analog of the Gamow-Teller constant, must vanish in the limit of zero momentum transfer. This result implies that either the mass of the meson, if it exists, is non-zero, or its effective coupling with the nucleon is zero. (T.F.H.)

24729 MASS OF THE YANG-MILLS VECTOR FIELD. J. P. Vigier (Institut Henri Poincaré, Paris). Nuovo cimento (10), 23: 1171-4(Mar. 16, 1962). (In English)

The possibility of associating a mass-like term with the three vector mesons B^k of the Yang-Mills field theory is examined, assuming that the initial Lagrangian is invariant under the isobaric three-dimensional rotation gauge group R_3. The further assumption is made that the Yang-Mills field is made up of a non-observable, strongly and rapidly fluctuating part superposed on the observable regular part of the solution. It is found that a mass, dependent on the properties of the non-observable part, can be associated with the B^k, given that this non-observable part exists. It is further found that mass terms of this type can only be associated with vector mesons connected with R_3-type groups, and not connected with one-dimensional abelian gauge groups R_2. It is thus concluded that these abelian groups cannot be used to explain hypercharge and baryon-number conservation if the rest masses of the particles studied are finite. (T.F.H.)

24730 ENERGY-DEPENDENCE OF PION ASYMMETRY IN ANTIPROTON–PROTON ANNIHILATION. A. Stajano (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10), 24: 774-87 (June 1, 1962). (In English)

The model of Koba and Takeda (Prog. Theor. Phys., 19: 269(1958)) is extended to proton-antiproton annihilations in flight. Performing a Lorentz transformation on the cloud's pion momentum spectrum, deduced by a fixed source meson theory, energy-dependence of subsequent pion asymmetry is studied and agreement with experimental data at 1610 Mev/c is found. (auth)

24731 THEORY OF FERMION SYSTEMS WITH ATTRACTIVE INTERACTIONS: EXACT SOLUTION OF THE BCS REDUCED HAMILTONIAN. A. Klein (Univ. of Pennsylvania, Philadelphia). Nuovo cimento (10), 24: 788-813 (June 1, 1962). (In English)

A Barden-Cooper-Schrieffer type of reduced Hamiltonian, with an arbitrary pairing interaction is studied using the method of temperature-dependent Green's functions. The equations are solved by expansion in powers of N^{-1}, where N is the number of particles, and elements of a proof are given that these equations possess at most three classes of solutions: the normal solution in which all correlations are absent (to order unity), a solution which requires in addition two particle correlations and corresponds to that of BCS, and a solution in which all correlations must be retained. Only the BCS case is treated. A new derivation of the complete thermodynamics is given. By considering the perturbation by an external field, the underlying matrix structure of the theory is indicated. (auth)

24732 SINGULARITIES OF SCATTERING AMPLITUDES AT ISOLATED REAL POINTS. D. I. Olive and J. C. Taylor (Univ. of Cambridge, Eng.). Nuovo cimento (10), 24: 814-22(June 1, 1962). (In English)

Examples of Feynman integrals for scattering amplitudes are investigated, to determine the conditions under which Mandelstam's representation is invalidated by singularities within the support of the spectral function. The examples considered are consistent with a simple Pythagorean criterion for the scattering particles not to possess structure. (auth)

24733 ON THE THREE-BODY GREEN'S FUNCTION FOR S-STATES. V. Gallina (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin), P. Nata, L. Bianchi, and G. Viano. Nuovo cimento (10), 24: 835-47(June 1, 1962). (In English)

Kinematics of a system of three particles without spin and without interaction are studied, considering S-waves only. Co-ordinates allowing the separation of the variables in a simple way are introduced. The main result is the partial S-wave Green's function of the system. The triangular calculus, a useful tool in avoiding lengthy formulas and in clarifying the symmetry properties of the system, is introduced. (auth)

24734 ($\pi-\pi$) AND ($K-\pi$) RESONANCES. S. N. Biswas and V. Gupta (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10), 24: 848-52(June 1, 1962). (In English)

The exchange of Sakurai's B_T quanta (Ann. Phys., 11: 1 (1960)) explains the occurrence of ρ and K^* resonances. Characteristics of these resonances were calculated using the N/D method of dispersion theory. (auth)

24735 SELECTION RULES FOR $N\bar{N}$ ANNIHILATION INTO INTEGRAL ISOSPIN MESONS. W. G. Holladay and P. H. Moravek (Vanderbilt Univ., Nashville). Nuovo cimento (10), 24: 853-63(June 1, 1962). (In English)

Selection rules based on conservation of parity, angular momentum, charge conjugation, G-conjugation, and isospin are obtained for N-$\bar{N}$ annihilation into π (pseudoscalar-isovector), ρ (vector-isovector), ω (vector, isoscalar), η (vector-isoscalar), ϵ (pseudoscalar, isoscalar) and ζ (pseudovector-isoscalar) mesons. Angular distributions of certain directions such as the normal to the planes of the 3-π decay of the ω, η, ϵ, and ζ particles and the direction between 2-π decay of the ρ are deduced for S-state N-$\bar{N}$ annihilation. Observation of such distributions would confirm the quantum numbers assigned to these particles. It may be determined whether isotopic spin is conserved in these processes. (auth)

24736 RELATION BETWEEN FOLDY-WOUTHUYSEN AND LORENTZ TRANSFORMATIONS. R. H. Good, Jr. (Ames Lab., Ames, Iowa) and M. E. Rose. Nuovo cimento (10), 24: 864-9(June 1, 1962). (In English)

In the Dirac theory of a free electron, the Foldy-Wouthuysen transformation corresponds to the Lorentz transformation from the laboratory to the rest system of the electron, with a factor which preserves the norm of the wave function. This consideration resolves the ambiguity in the Foldy-Wouthuysen transformation. Covariantly-

defined Lorentz-tensor operators may be interpreted as Lorentz transforms of matrix operators from the rest to the laboratory system. (auth)

24737 HYPERON AND KAON PRODUCTION BY 16 Gev/c NEGATIVE PIONS ON PROTONS. J. Bartke (CERN. Geneva), R. Budde, W. A. Cooper, H. Filthuth, Y. Goldschmidt-Clermont, et al. Nuovo cimento (10), 24: 876-95(June 1, 1962). (In English)

Strange-particle production by 16 Bev/c negative pions in hydrogen was studied. 60,000 pictures were taken using the CERN 32-cm hydrogen bubble chamber. The cross sections found for associated and $K\bar{K}$ pair production are $\sigma_{YK} = 1.32 \pm 0.15$ mb, $\sigma_{K\bar{K}} = 2.21 \pm 0.25$ mb. The angular distributions of the Λ^0 and Σ^+ hyperons show a pronounced backward peaking in the pion-proton cms. The backward peak is less pronounced for Σ^-. The ratio Σ^+/Σ^- is 1.3 ± 0.3 at production. The neutral kaons are significantly peaked forward. The average longitudinal momentum in the cms is 0.26 ± 0.05 Bev/c along the direction of the incident pion. The average transverse momentum is small, ~0.5 Bev/c, and possibly independent of the kind of particle produced. Results indicate a higher mean value for $\Sigma^{\pm}$ than for Λ^0 and K^0. The average pion multiplicities are: for Y + K production 4.9 ± 0.1, for K + $\bar{K}$ production 4.0 ± 0.1. The kinetic energy distributions were compared with the predictions of the statistical theory. The contribution of nonstatistical processes is important. Different estimates give 30% as a lower limit. (auth)

24738 ACNODES ON LANDAU CURVES FOR DEUTERON PHOTODISINTEGRATION. K. Nishimura (Rutgers Univ., New Brunswick, N. J.). Nuovo cimento (10), 24: 896-902(June 1, 1962). (In English)

An implicit expression is derived for the occurrence of acnodes on the Landau curve of a reduced sixth-order diagram. This expression is studied for a certain class of graphs for deuteron photodisintegration and, in these cases, gives no singularities on the physical sheet. (auth)

24739 MAGNETIC MOMENTS OF BARYONS IN A SYMMETRY HIGHER THAN CHARGE-INDEPENDENCE. S. N. Biswas (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10), 24: 903-6(June 1, 1962). (In English)

Relations among the magnetic moments of baryons sharing certain strange-particle strong-interaction symmetries were deduced. (auth)

24740 INTERACTION RANGE AND HIGH-ENERGY SCATTERING. M. Lévy (Laboratoire de Physique Theorique et Hautes Energies, Orsay). Nuovo cimento (10), 24: 920-32(June 1, 1962). (In English)

A lower limit (R_{min}) of the interaction radius is calculated in terms of total and elastic cross sections without assuming that only a finite number of partial waves contribute to the scattering. It is shown that R_{min} can be evaluated exactly in the high-energy limit if the scattering amplitude satisfies a Mandelstam representation. Consequences on the range of the proton-antiproton interaction are discussed. A different estimate of R_{min} is made in the framework of diffraction scattering theory. (auth)

24741 THE GAUGE PRINCIPLE IN NONLEPTONIC WEAK INTERACTIONS. W. B. Zeleny (Univ. of Sydney). Nuovo cimento (10), 24: 940-50(June 1, 1962). (In English)

Basing the nonleptonic weak interaction on a gage principle of internal symmetries is investigated. The violation of the $|\Delta T| = 1/2$ rule and the relative rates of leptonic and nonleptonic decays can be explained by such a scheme, provided it is assumed that the leptonic weak interaction is generated by a gage principle of conservation of fermion number. A model for nonleptonic weak interactions, based on the doublet approximation (DA) theory of Pais, is devised. The model is speculative but illustrates a means whereby the gage principle and the DA scheme of nonleptonic weak interactions can be combined to give a theory consistent with experiment. (auth)

24742 LEPTON CONSERVATION USING ISOTOPIC DISPLACEMENT. W. G. Holladay and C. E. Roos (Vanderbilt Univ., Nashville). Nuovo cimento (10), 24: 951-6 (June 1, 1962). (In English)

Isotopic spin and isotopic displacement U/2 are assigned to leptons using the formula $q = U/2 + T_3$ and the assumption that the muon is an isosinglet and that the $e^-\nu$ is an isodoublet. A scheme that allows interactions involving fermions only if they can form a pair with a U of 0, ±1 is postulated. Selection rules for weak, strong, and electromagnetic interactions, in agreement with known reactions, are given. Reactions that can test some of the proposed rules are listed. (auth)

24743 ON THE UNIQUENESS OF THE ANALYTIC CONTINUATION OF THE S MATRIX IN ANGULAR MOMENTUM. G. M. Prosperi (Univ. of California, Berkeley). Nuovo cimento (10), 24: 957-62(June 1, 1962). (In English) (UCRL-10116)

Asymptotic conditions for $l \to \infty$ are discussed; the analytic continuation of the S matrix in angular momentum is unique. (auth)

24744 SOME REMARKS ABOUT PION–PION INTERACTION FROM PION PRODUCTION EXPERIMENT. J. N. Chahoud (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10), 24: 963-7 (June 1, 1962). (In English)

In single-π production in π-N interactions, a π-π resonance in the J = 1, T = 1 state was proposed. Results are phenomenologically analyzed to obtain information on the S-wave π-π interaction in the T = 2 state. Depression of the resonance peak below the limit required by unitarity for pure elastic p-wave scattering is explained. It is assumed that the process $\pi^- + p \to \pi^- + \pi^0 + p$ takes place via the 1-π exchange interaction and that the Chew-Low formula is valid exactly in the physical region for small momentum transfer to the nucleon. No extrapolation procedure to the pole $\Delta^2 = -\mu^2$ is accomplished. (L.N.N.)

24745 EFFECTIVE-FIELD APPROACH TO THE PROBLEM OF INTERACTING POLARIZED PARTICLES. K. Compaan and H. Zijlstra (N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Phys. Rev., 126: 1722-3(June 1, 1962).

The potential interaction energy of a cubic lattice of aligned polarized spheroids, of a random assembly of aligned polarized spheroids, and of a random assembly of arbitrary particles is calculated using the "effective-field approach." The dependence of the energy on the packing density of the particles is considered. Only systems polarized to saturation are treated. (auth)

24746 MONTE CARLO CALCULATION OF TRANSPORT OF FAST ELECTRONS. J. F. Perkins (Army Ordnance Missile Command, Redstone Arsenal, Ala.). Phys. Rev., 126: 1781-4(June 1, 1962).

Transmission, backscattering, and spatial distribution of ionization energy loss of electrons in thick absorbers were calculated by a random-sampling method using an IBM-7090 digital computer. Results are presented for 0.4 to 4.0-Mev electrons normally incident on C, Al, and Cu absorbers. Ratios of extrapolated range of monoenergetic electrons to total range at incident energy varied from 50 to 90%, to depend only weakly on incident energy, and de-

creased with increasing atomic number of absorber. Back-scattering coefficients decreased with increasing energy in this range and agree with the data of Frank; values of (4.2 ± 0.9)% and (16.6 ± 1.8)% were obtained for 2-Mev electrons incident on Al and Cu. (auth)

24747 MOTT SCATTERING OF POLARIZED MUONS. Marcel Bardon, Paolo Franzini, and Juliet Lee (Columbia Univ., New York). Phys. Rev., 126: 1826-35(June 1, 1962).

An experimental determination was made of the helicity of muons from π^- decays and the cross sections for scattering from lead by Mott scattering. With $(2.0 \pm 0.3) \times 10^8$ muons incident on the scatterers, a left-right asymmetry of -0.090 ± 0.031 was measured for 1163 ± 60 scattering events. Checks indicated negligible systematic asymmetries. The sign of the asymmetry shows a positive helicity for the negative muon in pion decay in agreement with V-A theory. Agreement of the magnitude of the asymmetry and of the number of events with the ones predicted for the experimental arrangement (0.081 ± 0.001 and 1210 ± 220, respectively) confirms the results of experiments indicating a purely electromagnetic behavior for muon scattering. The average momentum transfer was 110 Mev/c. Mott scattering of transversely polarized fermions was measured. (auth)

24748 EVIDENCE CONCERNING PION-PION INTERACTIONS BELOW THE 765-Mev PION-PION RESONANCE. C. Clyde Peck, Lawrence W. Jones, and Martin L. Perl (Univ. of Michigan, Ann Arbor). Phys. Rev., 126: 1836-44 (June 1, 1962).

A search was made for π-π resonances in the reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ at 871 and 775 Mev, using a sodium-iodide luminescent chamber as a detector. The spectra of m*, the total energy of the 2 pions in their own barycentric system, are presented and compared with the spectra predicted by phase-space alone. The maximum m* is 695 Mev, and the recoil proton momenta are 400 to 700 Mev/c. The 871-Mev spectrum shows a deviation from the phase-space prediction in the form of an abrupt rise at an m* of 590 Mev. This rise is most prominent for the spectrum with recoil proton momenta above 550 Mev/c. The 775-Mev spectrum does not show any strong deviations from phase space. It is concluded that the peak above phase space in the m* spectrum range of 575 to 700 Mev is due to at least one other process besides the 765-Mev 2-π resonance particular. The possible existence of a new two-pion, T = 1 resonance with an m* of about 600 Mev is discussed. An evaluation of the performance of the luminescent chamber is made. (auth)

24749 PARITY OF THE NEUTRAL PION AND THE DECAY $\pi^0 \rightarrow 2e^+ + 2e^-$. N. P. Samios (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.), R. Plano, A. Prodell, M. Schwartz, and J. Steinberger. Phys. Rev., 126: 1844-9(June 1, 1962).

Using a hydrogen bubble chamber, 206 electronic decays of the π^0, $\pi^0 \rightarrow e^+ + e^- + e^+ + e^-$, were observed. The decay distributions of the electron pairs and the total rate agree with theory. An examination of correlations of the e^+e^- pair decay planes on the basis of electrodynamic predictions agrees with the hypothesis that the π^0 is pseudoscalar but disagrees for scalar pions by 3.6 standard deviations. (auth)

24750 PION-PION INTERACTION IN THE REACTION $\bar{p} + p \rightarrow 2\pi^+ + 2\pi^- + n\pi^0$. Janice Button, George R. Kalbfleisch, Gerald R. Lynch, Bogdan C. Maglić, Arthur H. Rosenfeld, and M. Lynn Stevenson (Univ. of California, Berkeley). Phys. Rev., 126: 1858-63(June 1, 1962). (UCRL-9814)

Deviations from the expected 2-π effective-mass distributions were found in the reaction $\bar{p} + p \rightarrow 2\pi^+ + 2\pi^- + n\pi^0$. These occur in two regions, 300 and 750 Mev, and could be explained by the T = 0, π-π interaction and the ρ meson (T = 1, J = 1$^-$ π-π resonance). The data in the 750-Mev region for $\pi^+\pi^-$ combinations (Q = 0) show an apparent double-peak structure—one at 720 (Γ = 20 Mev), the other at 780 Mev (Γ = 60 Mev). However, the |Q| = 1 data ($\pi^+\pi^0$ and $\pi^-\pi^0$ combinations) are consistent with the single T = 1 J = 1$^-$ resonance. Data give M_ρ = 767 Mev (Γ = 110 Mev). As these parameters also fit the Q = 0 data, a discussion of the statistical significance of the 1-peak and 2-peak hypotheses is given. A search was made for neutral decay modes of the heavy mesons; no evidence was found. (auth)

24751 ELECTROSTATIC CORRECTIONS TO NUCLEON-NUCLEON DISPERSION RELATIONS. David Y. Wong (Univ. of California, San Diego) and H. Pierre Noyes. Phys. Rev., 126: 1866-72(June 1, 1962).

Assuming that a nonrelativistic wave-function description of the nucleon-nucleon scattering system is valid at low energy and large distances, analytic properties of nuclear (i.e., total minus Coulomb) partial wave scattering amplitudes are investigated as functions of the c.m. momentum q. For singlet states, the essential singularity at $q^2 = 0$ can be treated exactly in the partial wave dispersion relation. The remaining singularities are branch points located at the same position as for the non-Coulomb case. The discontinuity across the 1-π exchange cut is a simple multiplicative factor (which goes to unity as e^2 goes to zero) times the discontinuity in the absence of Coulomb scattering. From this structure, an integral equation for the partial wave scattering amplitude is derived. Consequences of these corrections in the $^1S_0$ state are investigated. For $q^2 < -\mu^2$, there are additional electrodynamic corrections to the interaction produced by multi-pion exchange. These should be, at most, of about the 3½% mass difference between charged and neutral pions. Any phenomenological treatment of the multi-pion exchange should differ by, at most, 3½% between n-p and p-p scattering. Representing this interaction by a single pole, but including exactly, single-pion exchange, and the charged-neutral pion mass difference in that exchange, the low-energy $^1S_0$ n-p and p-p scatterings are consistent with charge independence. Assuming exact charge symmetry, an n-n scattering length of −27 ± 1.4 fermi is predicted. Since a departure from charge symmetry of ±5% would vary this prediction between −18 and −53 fermi, a measurement of this quantity will provide a sensitive quantitative test of charge symmetry. (auth)

24752 VIRTUAL PARTICLES. Asim O. Barut (Univ. of California, Berkeley). Phys. Rev., 126: 1873-5(June 1, 1962). (UCRL-9993)

Particles or resonances not corresponding to the Breit-Wigner type poles in the partial wave amplitudes are defined. They are described in terms of the trajectory of the poles of the S matrix in the complex angular-momentum plane as a function of energy, when this trajectory does not reach a physical value of J. Range and scattering parameters are used to determine the trajectories near the threshold, which are related to high-energy cross sections for processes in which these particles are exchanged in the cross channels. The trajectories for the I = 0, π-π, S-wave "virtual state" and the single n-p S-wave "virtual state" as well as the triplet n-p trajectory, are determined. (auth)

24753 LONG-RANGE SCALAR INTERACTION. R. H. Dicke (Princeton Univ., N. J.). Phys. Rev., 126: 1875-7 (June 1, 1962). (PUC-1962-58)

The long-range scalar field, associated with a neutral, massless, boson, is generally considered to be nonexistent. This is based on the lack of overt effects, observed in the laboratory, from such a field. If this long-range interaction were to exist, it would of necessity be weak. The physical reason for this is the large contribution, having its origin in the enormous amount of matter at great distance in the universe, to the magnitude of the scalar. The contribution of local matter is miniscule, leading to a weak interaction of about the same strength as gravitation. Such an interaction, in its effects, would be very similar to gravitation and could be distinguished only with difficulty. There is not yet a compelling observation which could be used to exclude the long-range scalar interaction. (auth)

24754 INFLUENCE OF A RESONANT ABSORBER WHOSE THICKNESS VARIES LINEARLY WITH TIME ON THE SPECTRAL SHAPE OF AN INCIDENT LORENTZIAN WAVE PACKET. I. Nowik (Hebrew Univ., Jerusalem). Phys. Rev., 126: 1878-9(June 1, 1962).

The influence of a resonant absorber whose thickness varies linearly with time on the spectral shape of an incident Lorentzian wave packet is discussed, using classical dispersion theory. The resonant line is broadened and, for sufficiently high velocities with which the thickness of the absorber changes, the line is split into two bands with a minimum at the resonant frequency ω_0. (auth)

24755 SOLUBLE MANY-BODY PROBLEM FOR PARTICLES IN A COULOMB POTENTIAL. M. Moshinsky (Universidad de México, Mexico City). Phys. Rev., 126: 1880-1(June 1, 1962).

Using the accidental degeneracy of the energy levels in a Coulomb potential, a correlated wave function for a system of n particles in this potential is constructed. (auth)

24756 THE POLARIZATION OF QUASI-MONOCHROMATIC BREMSSTRAHLUNG BY A SINGLE CRYSTAL. H. Ueberall (University of Michigan, Ann Arbor). Z. Naturforsch., 17a: 332-4(Apr. 1962). (In German)

It is shown that the quasi-monochromatic bremsstrahlung discovered recently by Diambrini and coworkers which is given off by energetic electrons crossing through a single crystal is linearly polarized to a high degree. (tr-auth)

24757 GAMMA-LUCHI. (Gamma Rays). L. A. Sliv, ed.-in-chief. Moscow, Publishing House of the Academy of Sciences, USSR, 1961. 720p.

Data are presented on the probabilities of γ radiation in nature and the quantum characteristics of nuclear levels. Various processes associated with γ emission are analyzed. Nuclear transitions in shell models, intrinsic γ-ray conversions, nuclear pair production conversions, angular correlations in nuclear transitions, and elastic γ-ray interactions with nuclei in crystals (Mössbauer effect) are discussed. Extensive data offered by various specialists in their fields and a great number of graphs, tables, and nomograms are included in this encyclopedia-type handbook designed for theoretical and experimental physicists working with nuclear spectroscopy and allied subjects. (R.V.J.)

Neutron Physics

24758 (AE-71) THE SPACE-, TIME-, AND ENERGY-DISTRIBUTION OF NEUTRONS FROM A PULSED PLANE SOURCE. Arne Claesson (Aktiebolaget Atomenergi, Stockholm). May 1962. 16p.

The space-, time-, and energy-distribution of neutrons from a pulsed, plane, high-energy source in an infinite medium is determined in a diffusion approximation. For simplicity the moderator is first assumed to be hydrogen gas, but it is also shown that the method can be used for a moderator of arbitrary mass. (auth)

24759 (AE-77) THE RESONANCE ABSORPTION OF URANIUM METAL AND OXIDE. E. Hellstrand and G. G. Lundgren (Aktiebolaget Atomenergi, Studsvik, Sweden). June 1962. 17p.

The resonance integrals for uranium metal and uranium oxide were determined for a 1/E flux. The following results were obtained: metal RI = $2.95 + 25.8\sqrt{S/M}$ and oxide RI = $4.15 + 26.6\sqrt{S/M}$. The oxide value agrees with the expression found earlier, but the result for the metal is 4.5% larger. In addition, the resonance absorption in a R1 fuel rod was compared with that for a cadmium-covered rod placed in an approximate cell boundary flux. The former came out 3% larger than the latter. A comparison of the fuel rod absorption with that for a 1/E flux yields a corresponding figure of 7%. The neutron flux was monitored below the lowest resonance in uranium. (auth)

24760 (CRT-1079) NEUTRON ABSORPTION IN A COMPOSITE CYLINDER. S. A. Kushneriuk and R. Roskies (Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.). Feb. 1962. 58p. (AECL-1540)

There was some interest in estimating the neutron absorption rate in a composite cylinder consisting of an absorbing and scattering inner region contained by a purely absorbing wall, the cylinder being embedded in a large, predominantly scattering medium containing neutron sources. Results that are basic to the determination of the absorption rate in the cylinder are presented, and the accuracy of low order spherical harmonic approximations to this rate when Marshak type boundary conditions are used at the absorbing annular wall are examined. The treatment is one-velocity. In the diffusion approximation, in the absence of sources in the cylinder, the absorption rate in the cylinder is derived from the current at the cylinder surface, the latter being calculated from the diffusion approximation flux distribution in the medium surrounding the cylinder. For an accurate determination of the flux distribution, the cylinder blackness and extrapolation length boundary condition are needed and these are specified. The method is extended to take account of neutron sources that may be present in the cylinder. The low order spherical harmonic approximations for the absorption turn out to be rather inaccurate particularly in the case of small, nearly black absorbers, though the Marshak type boundary conditions do improve the accuracy of a given approximation. (auth)

24761 (TID-15667) KSU PILE STANDARDIZATION AND STUDY OF SLOWING DOWN AND DIFFUSION MODELS (thesis). Larry Ray Foulke (Kansas State Univ., Manhattan. Engineering Experiment Station). 1961. 162p.

Kansas State Univ. Eng. Expt. St., Spec. Rept. No. 8.

A description of the investigation is given which includes a discussion of background and the theory of thermal neutron diffusion, a description of the pile and counting facilities, experimental procedure, data analysis, and a discussion of results. Information is also included concerning solution to diffusion equations, and computer applications in flux and diffusion calculations. (J.R.D.)

24762 (TID-15743) A RANGER STUDY OF THE Po–Be NEUTRON SPECTRUM (thesis). Herbert Gursky (Vanderbilt Univ., Nashville). 1953. 65p.

Automatic counting equipment making direct range measurements by detecting particles at the end of their range were used to determine the neutron spectrum from

a Po–Be source. A description of the equipment and procedure is presented including general arrangement, the counters, absorbers and changing mechanism, response of counters, electronic components, elimination of spurious responses, source and radiator, range of energy studied, selection of particles, and accumulation of data. The conversion of range counts to neutron spectrum is discussed along with possible errors. Data are presented in tabular form. (M.C.G.)

24763 (TRG-Report-229) A COMPUTER PROGRAM TO SOLVE THE MULTIGROUP DIFFUSION EQUATIONS. A. Hassitt (United Kingdom Atomic Energy Authority. Reactor Group, Risley, Lancs, England). Mar. 8, 1962. 39p.

A program, which solves the multigroup diffusion equations in two dimensions (RZ, XY, RΘ) and in one dimension (slab, cylindrical or spherical geometry) on the IBM 704 or 7090 computer, is described. Up to 100 energy groups may be used and neutrons may scatter from any group to any other. The program will compute the k effective of the system, or alternatively it will search for criticality by varying material composition, or by varying the reactor buckling, or by moving spatial boundaries. It will also solve source type problems. There is a standard print of final flux values. There is also a powerful general output routine, which is in fact a compiler. Output instructions are given in algebraic form, as part of the data to the program. The user can easily direct the processing of results so that complicated summing and integrating of the results can be done. Cross-sections may be put in directly or they may be obtained from the multigroup library in the program: a group condensation program is provided. (auth)

24764 (WAPD-T-1497) EFFECTIVE U^{238} RESONANCE CAPTURE INTEGRALS IN RODS AND LATTICES. D. Klein, J. Hardy, Jr., G. G. Smith, and S. Stein (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). May 1962. Contract AT(11-1)-Gen-14. 37p.

Presented at "Panel on Light Water Lattices" Vienna, Austria, May 1962.

Measurements were made of U^{238} resonance neutron capture in isolated uranium metal and UO_2 rods. Monte Carlo calculations of resonance integrals were made to investigate the range of validity of the equivalence relations under idealized conditions. Resonance integrals were also inferred from measurements of the resonance escape probability for a number of different lattices. These results were then correlated with the isolated rod measurements by using two of the suggested equivalence relations. (M.C.G.)

24765 (AEC-tr-5143) STUDY OF THE DIFFUSION AND THERMALIZATION OF NEUTRONS IN WATER AND ICE WITHIN A WIDE RANGE OF TEMPERATURES, USING THE IMPULSE METHOD. A. V. Antonov, B. V. Granatkin, Yu. A. Merkul'ev, and Ch. K. Smolik. Translated from p.377-94 of "Proceedings of the Symposium on Inelastic Scattering of Neutrons in Solids and Liquids, held in Vienna, October 11-14, 1960." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/35(p.377-94)). 24p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 7166.

24766 (AEC-tr-5146) NEUTRON THERMALIZATION AND THE PROPERTIES OF THE VAN HOVE PAIR CORRELATION FUNCTION. M. V. Kazarnovskiĭ and A. V. Stepanov. Translated from p.87-95 of "Proceedings of the Symposium on Inelastic Scattering of Neutrons in Solids and Liquids, held in Vienna, October 11-14, 1960." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/35(p.87-95)). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 7149.

24767 (AEC-tr-5156) EXPERIMENTAL DETERMINATION OF THE SPECTRUM FOR THERMAL OSCILLATIONS OF CRYSTALS OF ARBITRARY SYMMETRY BY MEANS OF INCOHERENT SINGLE-PHONON SCATTERING OF COLD NEUTRONS. L. V. Tarasov. Translated from p.479-83 of "Proceedings of the Symposium on the Inelastic Scattering of Neutrons in Solids and Liquids, held in Vienna, October 11-14, 1960." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/35(p.479-83)). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 7171.

24768 (AEC-tr-5158) SCATTERING OF NEUTRONS IN LIQUIDS. V. F. Turchin. Translated from p.259-64 of "Proceedings of the Symposium on the Inelastic Scattering of Neutrons in Solids and Liquids, held in Vienna, October 11-14, 1960." (A publication of the International Atomic Energy Agency, Vienna, 1961.) (STI/PUB/35(p.259-64)). 10p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 7157.

24769 (AEC-tr-5204) AN ANALYTICAL METHOD OF SOLUTION FOR THE ENERGY DEPENDENT NEUTRON TRANSPORT PROBLEM. Hans Hejtmanek. Translated by D. H. Roy (Babcock and Wilcox Co., Lynchburg, Va.) from Atomkernenergie, 6: 350-3(Sept. 1961). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 4742.

24770 THE YVON APPROXIMATION METHOD III. H. Kellner (Österreichische Hochschue, Vienna). Atomkernenergie, 7: 201-3(June 1962). (In German)

The solution of the Milne-problem at the boundary is given and the exact relation between flux and current in the case of no absorption is derived. The approximative solution obeys a transport equation, which is set up here. It is demonstrated that a certain part of the solution for the angular distribution should converge to its exact value. (auth)

24771 STATISTICAL ERRORS IN THE NEUTRON FLUX LEVEL PARAMETERS IN THE LOW ENERGY REGION. V. G. Zolotukhin. Atomnaya Energ., 12: 467-71(June 1962). (In Russian)

The statistical errors in the values of neutron flux level parameters must be exactly known and the boundaries of uncertainty must be clearly indicated in order to derive the maximum benefit from the data obtained. This problem is of special importance for neutron spectroscopy techniques. Statistical methods were used therefore for analyzing the errors in neutron resonance experiments, employing 2 fundamental methods: the least-squares methods, for satisfactory level resolution and the area method in case of poor level resolution. For the first case the optimum thicknesses of the specimens were calculated, taking into account, in addition to the statistics of the readings, the effect of background and other sources of error. For the second case, special tables were compiled, calculating the errors of the σ_0, $\sigma_0\Gamma$, and $\sigma_0\Gamma^2$ parameters under known conditions. As an example, the resonance of U^{238} at 6.7 ev were analyzed, making use of the data of J. Harvey et al., (Phys. Rev., 99: 10(1955)). It was found that the accuracy of the measurements decreases considerably if the thicknesses of the specimens used differ only by a factor

of 2 to 5, especially in the case of a strong Doppler broadening. (TTT)

24772 TWO-GROUP PLANE BOUNDARY CONDITIONS IN SQUARE LATTICES. L. Trlifai (Inst. of Nuclear Studies of the Czechoslovak Academy of Sciences, Prague). Atomnaya Energ., 12: 519-22(June 1962). (In Russian)

A method used for determining plane boundary conditions for homogenized asymptotic thermal-neutron densities and for its derivative in square lattices was previously described (Atomnaya Energiya, 11: 221(1961) No. 3). A variation of the previously given configuration is considered, assuming that the space is filled by the same moderator. This case may also be solved by the same method. Functions are obtained in the 2-group approximation for the moderator and for the diffusion of neutrons within it, using the previously given equations. By fulfilling the requirement of homogenization it is shown that the 2 cases may be expressed by a single equation. Results of the calculations agree well with A. D. Galanin's data ("Theory of Thermal-Neutron Reactors" (in Russian), Atomizdat 1958) on the 2-group theory for a square lattice and for a homogeneous reactor with an infinite reflector. (TTT)

24773 THE SPECTRUM OF SLOWING-DOWN NEUTRONS REFLECTED FROM A HOMOGENEOUS HALF SPACE. T. Kh. Sedel'nikov. Atomnaya Energ., 12: 522-4 (June 1962). (In Russian)

In a previous work (Atomnaya Energiya, 11: 449(1961) No. 5) the dependence of the total intensity of the reflected neutron flux on time for an elastically and isotropically scattering half space was established. This problem was further developed by considering the energy spectrum of neutrons reflected from a homogeneous, slowing-down half space, limiting the problem to low-energy neutrons, i.e., neutrons undergoing repeated collisions. The formulas derived are valid for any geometry. The isotropic temperature of the half space was calculated from the total isotropic albedo. (TTT)

24774 INVESTIGATIONS ON THE MODERATING PARAMETERS OF "DOWTHERM A" AT DIFFERENT TEMPERATURES. Lénárd Pál, István Kiss, and Lajos Bata. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 207-21(July-Aug. 1958). (In Hungarian)

Moderating parameters of a medium consisting of 26.81% diphenyl and 73.19% diphenyl oxide are tested at different temperatures. The temperature dependence of the diffusion length is found to obey the empirical relation $L_D = 4.002 \exp [0.0014\ T]$. The slowing down length is found to be $L_S = 11.24 \pm 0.06$ cm at 36°C. At elevated temperatures the slowing-down length increases considerably, so that the testing tank cannot be considered as being of infinite size. Therefore only the temperature dependence of the most probable slowing-down length for this tank of finite dimensions could be specified. (auth)

24775 STATISTICAL FLUCTUATIONS OF NEUTRON MULTIPLICATION. Lénárd Pál. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 222-45(July-Aug. 1958). (In Hungarian)

Statistical fluctuations of neutron multiplication are defined by the statistical fluctuations of the number of neutrons per fission and of the chain length. Using an assumption of very general character, the generating function of the distribution function describing the statistical behavior of neutrons in multiplying media is determined. Variance versus time is computed for multiplying systems of different reactivity, taking into account the effect of delayed neutrons. For the purpose of experimental investigations of neutron multiplication processes in subcritical systems, the relative variance of the number of neutrons recorded during a given time interval by a neutron detector inserted into the system is computed for the case of a pulsed neutron source. It is assumed that the number of neutrons in a neutron pulse follows a Poisson distribution and that the neutron pulse width may be neglected as compared with detection time. Variance of the number of (prompt and delayed) neutrons produced in fission may be determined from experimental results using the theoretical considerations discussed. (auth)

Nuclear Properties and Reactions

24776 (BNL-732) NEUTRON CROSS SECTION EVALUATION GROUP. Newsletter No. 6. Sophie Moore (Brookhaven National Lab., Upton, N. Y.). June 1962. Contract [AT(30-2)-Gen-16]. 11p.

Information is presented in the form of a newsletter to acquaint users of neutron cross section data with recent developments. It is noted that the data are in many cases preliminary and that the newsletter should be considered a source of information that the data exist rather than as a reference for established values. (J.R.D.)

24777 (CEA-2146) NOUVEAUX ASPECTS DE L'EXCITATION NUCLÉAIRE PAR DIFFUSION DE PARTICULES ALPHA (THESES). (New Features of Nuclear Excitation by α Particles Scattering (thesis)). Jean Saudinos (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1962. 86p.

Submitted to Université, Paris.

Inelastic scattering of medium energy α particles by nuclei is known to excite preferentially levels of collective character. The scattering of isotopically enriched targets of Ca, Fe, Ni, Cu, and Zn are studied. The theoretical features of the interaction are discussed and the experimental procedure is described. Results are presented and analyzed. Alpha particles scattering by Ca^{40} excites preferentially odd parity levels. In odd nuclei multiplets due to the coupling of the odd nucleon with the even-even core vibrations are observed. For even-even nuclei, a few levels are excited with lower cross-sections between the first 2^+ and 3^- states. Some could be members of the two phonon quadrupole excitation and involve a double nuclear excitation process. (auth)

24778 (CEA-2148) MESURE DE SECTIONS EFFICACES DE PHOTOPRODUCTION DE NEUTRONS EN VALEUR ABSOLUTE (THESES). (Measurement of the Absolute Values of Cross Sections in Neutron Photoproduction (thesis)). Claude Schuhl (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1962. 91p.

Submitted to Université, Paris.

The values of photoneutron production cross-sections for intermediate and heavy nuclei (lanthanum, cerium, tantalum, gold, lead, and bismuth) are determined within 15%. The results agree with theories in which the resonance is explained by the collective motion of the protons against the neutrons. The effect of the nuclear deformation on the shape of the resonance is demonstrated in Ta^{181}. (auth)

24779 (CRRP-1090) FISSION PRODUCT POISONING FROM THE FAST FISSION OF U-238. W. H. Walker (Atomic Energy of Canada Ltd., Chalk River, Ont.). June 1962. 26p. (AECL-1537)

Published radiochemical measurements of yields from the fast fission of U-238 are reviewed, and a complete set

of yields between masses 77 and 161 is recommended for use in fission product poisoning calculations. The pseudo-fission-product treatment is adopted to simplify presentation and handling of the data. The fission product thermal cross sections and resonance integrals are used with the new yields to obtain pseudo-fission product yields in the fast fission of U-238 for four epithermal neutron densities. The pseudo-fission product cross sections are 80, 300, and 800 b. (auth)

24780 (GA-2783) CHARGE TRANSFER IN COLLISIONS INVOLVING SYMMETRIC AND ASYMMETRIC RESONANCE. R. F. Stebbings, A. C. H. Smith, and W. L. Fite (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Jan. 5, 1962. 19p. (AD-271417)

The cross sections for charge transfer in collisions between atomic hydrogen and O(+) and He(++) ions are presented. Unique interest attaches to these processes because they may occur with small or zero energy defect. Theoretical conflict exists regarding the magnitude and energy dependence of the cross sections for accidental resonance collisions. Cross sections for symmetric resonance charge transfer between protons and atomic hydrogen are also presented for energies down to 20 ev. The experiments were carried out using the techniques of modulated crossed beams. (auth)

24781 (JINR-P-896) IZUCHENIE YADERNOI REAKTSII $Th_{90}^{232}(Ne_{10}^{22},4n)Fm_{100}^{250}$. (Nuclear Reactions of $Th_{90}^{232}(Ne_{10}^{22},4n)Fm_{100}^{250}$). E. D. Donets, V. A. Karnaukhov, G. Kumpf, B. A. Gvozdev, and Yu. T. Chuburkov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1962. 10p.

The dependence of the cross section for the reaction $Th^{232}(Ne^{22},4n)Fm^{250}$ on ion energy was measured. It was found to have a curve with a maximum of 107 Mev and halfwidth of 11 Mev. The maximum value of the cross section is 2.5×10^{-31} cm^2. The cross sections for the reaction are compared with those for the reactions of $Pu^{241}(C^{13},4n)Fm^{250}$ and $U^{238}(O^{16},4n)Fm^{250}$. (auth)

24782 (JINR-P-967) RASSEYANIE γ KVANTOV I POLYARIZUEMOST YADER I NUKLONOV. (Scattering of γ Quanta and Polarization of Nuclei and Nucleons). L. I. Lapidus (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 7p.

The definition of the polarizability of atomic nuclei and nucleons which is based on dispersion relations and the spin structure of γ-ray scattering amplitude is discussed. An estimation of the magnetic proton polarizability is obtained. The applications of crossing symmetry are indicated for the polarizability of nuclei with arbitrary spins. (auth)

24783 (JPL-TR-34-249) THE ENERGY SPECTRUM OF FISSION PARTICLES LEAVING A FUEL SHEET. Detlef Kamke (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Jan. 9, 1961. Contract NASw-6. 34p.

The velocity and energy distribution functions were calculated for fission fragments leaving a sheet of fissionable material. These distribution functions are dependent on the energy range relationship assumed. From the distribution functions, the current was calculated for the situation in which a positively charged anode is arrayed opposite to the fissionable cathode. (auth)

24784 (NP-11622) THE TRANSVERSE POLARIZATION OF INTERNAL CONVERSION ELECTRONS EMITTED FOLLOWING BETA DECAY (thesis). Technical Report No. 35. J. Bernard Blake (Illinois. Univ., Urbana). Mar. 1962. Contract ONR 1834 (05). 46p.

The transverse polarization of conversion electrons following beta decay was measured for eight different decays. Decays were studied for the following isotopes: Hg^{203}, Pa^{233}, Au^{198}, Au^{199}, Ce^{141}, Ce^{144}, Tm^{170}, and I^{131}. Electron polarization was measured by Mott scattering. Results are presented in tables. Corrections made to the raw data are described. (M.C.G.)

24785 (NP-11748) FUNCIÓN DE EXCITACIÓN DE LA REACCIÓN $Al^{27}(d,p)Al^{28}$ ENTRE 2,2 Y 12,6 Mev. INFORME NO. 65. (Excitation Function of the Reaction $Al^{27}(d,p)Al^{28}$ from 2.2 to 12.6 Mev. Report No. 65). Jorge Merlo Flores (Argentina. Comision Nacional de Energía Atómica, Buenos Aires). 1962. 12p.

The excitation function is measured for the reaction $Al^{27}(d,p)Al^{28}$ between 2.2 and 12.6 Mev. The calibration of the excitation function in absolute form is carried out by measuring simultaneously the excitation function of the reactions $Al^{27}(d,p)$ and $(d,\alpha p)$ and comparing the results obtained with those of Batzel et al. The maximum of the function is between 7 and 8 Mev, and is 239 ± 29 mb. The half life of Al^{28} was determined as 2.28 ± 0.06 min. (tr-auth)

24786 (NP-11791) RELACION DE LOS RENDIMENTOS DEL PAR ISOMERICO Te^{121m}, Te^{121}, FORMADO EN LA REACCION NUCLEAR $Sb^{121}(d,2N)Te^{121}$. INFORME NO. 61. (Relation of the Yield of the Isomeric Pair Te^{121m}, Te^{121}, Formed in the Nuclear Reaction, $Sb^{121}(d,2n)Te^{121}$. Report No. 61). S. J. Nassiff, S. Abecasis, and A. Mocoroa (Argentina. Comisión Nacional de Energía Atómica, Buenos Aires and Argentina. Universidad Nacional de la Plata). 1961. 8p.

The effective cross sections of the isomeric pair, tellurium-121m–tellurium-121 in the reaction antimony-121(d,2n)tellurium-121 were determined experimentally for deuteron energies from 9 to 28 Mev. (tr-auth)

24787 (NP-11793) [NEUTRON REACTIONS (n,p) AND (n,γ) WITH ISOTOPES OF LOW ATOMIC NUMBER]. A. Trier and L. Gonzalez (Chile. Universidad, Santiago). May 1961. 3p.

An examination was made of the reactions (n,p) and (n,γ) on some isotopes of low atomic number with neutrons provided by the reaction $D(d,n)H^3$ at E_D = 600 kev by the activation method. The isotopes were Cl^{35}, Cr^{52}, V^{51}, Ge^{74}, and Se^{80}. (tr-auth)

24788 (NP-11796) A FILAMENT SCINTILLATION CHAMBER MEASUREMENT OF THE RATE FOR $\mu^- + C^{12} \rightarrow B^{12} + \nu$. Technical Report No. 30. Donald B. Scarl (Princeton Univ., N. J. Palmer Physical Lab. and Princeton Univ., N. J. Naval Ordnance Lab.). May 29, 1962. Contract Nonr-1858(06). 73p.

To check the predictions of a Universal Fermi Interaction, negative muons were brought to rest in a $1\frac{1}{2}$ inch filament scintillator chamber and the rate for the reaction $\mu^- + C^{12} \rightarrow B^{12} + \nu$ was measured. 97 B^{12} events were observed, giving a capture rate of $(6.6 \pm 0.9) \times 10^3$ per second. This number is in agreement with the predictions of a Universal Fermi Interaction, a pion induced pseudoscalar term with $g_P = +8\ g_A$, and a conserved weak vector current. An extensive discussion of the construction and operation of the filament chamber and associated image tubes is included. (auth)

24789 (NP-11874) THE NUCLEAR PROPERTIES OF RHENIUM. Tenth Quarterly Technical Progress Report, March 8, 1962 through June 8, 1962. R. A. Karam, T. F. Parkinson, F. J. Munno, and E. E. Menge (Florida. Univ., Gainesville). Contract NOas 60-6021-c. 18p.

The (n,2n) cross sections for Re^{187} and Re^{185} were measured with 14.1 Mev neutrons from the $T(D,n)He^4$ reaction. The standard used was Au^{197}. Since the (n,2n) reaction with

Au^{197} results in Au^{196} and Au^{196*} with half-lives of 5.3 days and 14 hours, respectively, the cross section for Au^{196} was used as the standard. The cross section for $Re^{187}(n,2n)Re^{186}$ was found to be 1.44 ± 0.41 barns. An upper limit for the $Re^{185}(n,2n)Re^{184}$ cross section was found to be 1.80 ± 0.60 barns. The decay of Au^{196*} proceeds via isomeric transition to Au^{196}. (auth)

24790 (NRDC-123) THE VARIATION OF $\eta/\bar{\nu}$ FOR U^{235} FROM 6 eV TO 50 eV INCIDENT NEUTRON ENERGY. F. D. Brooks and E. R. Rae (United Kingdom Atomic Energy Research Establishment, Harwell, Berks, England). Oct. 1959. 11p.

The experimental method of measuring the variation is described along with data reduction. It was found that the first few levels observed in U^{235} are not typical as regards their fission widths when compared with the levels up to 50 ev. The average fission width for levels up to 6 ev is more than twice the average over all levels up to 50 ev; that is, the effective average of η decreases with increasing neutron energy over this region. (J.R.D.)

24791 (ORNL-3089) PROTON RECOIL ENERGY LOSS DISTRIBUTION IN PLANE GEOMETRY. H. B. Eldridge, P. R. Flusser, and R. H. Ritchie (Oak Ridge National Lab., Tenn.). July 10, 1962. Contract W-7405-Eng-26. 29p.

Computations of proton recoil energy losses from neutron irradiation of hydrogenous systems possessing plane symmetry were made for the purpose of fast neutron counter design. A digital computer code was written to carry out the calculations for two irradiation geometries: the neutron beam is assumed to be normally incident upon the system, and the system is exposed to an isotropic flux of neutrons. Numerical results are presented for neutrons of various energies incident on plane radiators of different thicknesses for these two irradiation geometries. These results were used in the conceptual design of fast neutron dosimeters employing a generalized dosimetry principle. (auth)

24792 (ORNL-3305) A SURVEY AND EVALUATION OF U^{233} FISSION YIELD DATA. R. L. Ferguson and G. D. O'Kelley (Oak Ridge National Lab., Tenn.). July 13, 1962. Contract W-7405-eng-26. 31p.

A survey of the pertinent literature was made to ascertain the status of data on U^{233} fission-product yields. The various experimental determinations were evaluated, and the most recent mass-spectrometric results were used as a basis for deriving a set of preferred yields. These yields were compared with values reported in two other recent compilations, and for yields >1%, the three sets agreed with each other to an average precision of <5%. It was concluded that recent measurements have somewhat improved the reliability of U^{233} fission yield data, but some recommendations for additional experimental work were made. (auth)

24793 (TID-12696) MEASUREMENTS OF (p,n) CROSS SECTIONS ON Cu at 9.85 Mev. G. A. Jones (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England); J. P. Schiffer (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England; Argonne National Lab., Ill.); J. R. Huizenga, and J. W. Wing (Argonne National Lab., Ill.). Mar. 1961. Contract [W-31-109-eng-38]. 9p. (UAC-5047)

Two independent measurements are reported which yielded results in drastic disagreement with earlier (p,n) cross section values for Cu^{63} and Cu^{65} at about 10 Mev. No reasonable explanation is apparent for the disagreement, however it is thought that generalizations on optical model fits should not be based on single measurements at a single energy on a single element. (J.R.D.)

24794 (TID-15211) LOW ENERGY NUCLEAR PHYSICS. Progress Report Covering Period June 1, 1961 to May 31, 1962. Research Proposal for June 1, 1962 to May 31, 1963. R. R. Roy (Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics). Feb. 1962. Contract AT(30-1)-2399. 49p.

Investigations covering a wide range of problems in nuclear physics are described. Research in progress in theoretical and experimental physics is reported, and a list of articles for publication is included concerning a new research building, general campus facilities, a proposed electron accelerator, a bunching magnet, and a scintillation spectrometer. (J.R.D.)

24795 (TID-15331) NUCLEAR ENERGY LEVELS IN P^{29}. M. W. Brenner, A. M. Hoogenboom, and E. Kashy (Massachusetts Inst. of Tech., Cambridge). [1962]. Contract [AT(30-1)-2098]. 11p.

Excited levels in P^{29} were observed as resonances in the differential elastic and inelastic scattering cross section for protons incident upon natural silicon (92.2% Si^{28}) at proton energies from 4.8 to 7.0 Mev. Resonances corresponding to 23 levels in P^{29} from 7.4 to 9.5 Mev excitation were observed. The orbital angular momenta of the incident protons were determined for most of the resonances using single-level dispersion theory. (auth)

24796 (UNC-5002) NEUTRON CROSS SECTIONS FOR TITANIUM, POTASSIUM, MAGNESIUM, NITROGEN, ALUMINUM, SILICON, SODIUM, OXYGEN, AND MANGANESE. Final Report, March 20, 1961–January 31, 1962. N. Tralli, M. H. Kalos, A. J. Longano, J. H. Ray, R. P. Sullivan, E. S. Troubetzkoy, and B. H. Trupin (United Nuclear Corp. Development Div., White Plains, N. Y.). Jan. 31, 1962. Contract DA-18-108-405-CML-1011. 123p. (NDL-TR-30)

A set of neutron cross sections for titanium, potassium, magnesium, and nitrogen was prepared for neutron energies from 0.0253 ev to 18 Mev. The cross sections tabulated include σ_T, $\sigma_{n,n}$, $\sigma_{n,\gamma}$, $\sigma_n(\theta)$, $\sigma_{n,n'}(E,E')$, $\sigma_{n,n'\gamma}(E,E_\gamma)$, $\sigma_{n,2n}$, and cross sections for charged particle emission. A revision of some of the neutron cross sections for Al, Si, Na, and O given in NDA 2111-3, Vol. C, Nov. 1, 1959 and NDA 2133-4, Jan. 31, 1961 was made based on experimental results which appeared in the literature since the publication of these reports. In addition, some typographical errors in the tabulation of $\sigma_{n,n}$ for Mn in NDA 2133-4 are corrected. The results of Hauser-Feshbach calculations of reactions of O^{16} are also reported. (auth)

24797 (WADC-TR-58-266) EFFECTIVE REMOVAL CROSS SECTION WITH A MONODIRECTIONAL SOURCE OF FISSION NEUTRONS. R. D. Schamberger (Wright-Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio). Jan. 1958. 48p. (AD-155598)

The effective fast neutron removal cross section, with a monodirectional fission source, was obtained for hydrogen, lithium, beryllium, boron, carbon, oxygen, fluorine, sodium, aluminum, sulfur, chlorine, titanium, iron, nickel, copper, cadmium, tungsten, lead, and bismuth. The cross section per atom for those elements with an atomic weight greater than 12 are approximated by the expression $\sigma = 0.40A^{0.43}10^{-24}cm^2$, where A is the atomic weight. These cross sections are significantly larger than the conventional removal cross sections obtained with a sample close to a distributed isotropic source. The increased effective cross section is ascribed to the fact that the angular distribution

of the incident neutrons is very strongly peaked in the forward direction. (auth)

24798 (WADD-TR-60-143(Pt.III)) RESEARCH STUDY TO DETERMINE THE PHASE EQUILIBRIUM RELATIONS OF SELECTED METAL CARBIDES AT HIGH TEMPERATURES. R. V. Sara and R. T. Dolloff (National Carbon Co., Parma, Ohio). Jan. 31, 1962. Contract AF33(616)-6286. 31p.

The result of investigations of phase equilibria in the binary systems tungsten–carbon and zirconium–carbon, are presented. A completed phase diagram for the tungsten–carbon system is presented which differs significantly from the one proposed by Sykes. The system is characterized by three binary phases, W_2C, α and β WC. A new cubic phase (β-WC) was discovered which is stable only above 2525°C. Eutectic temperatures of 2710 and 2765°C are observed in the tungsten-rich and carbon-rich sides of W_2C, respectively. A tentative phase diagram for the zirconium-carbon is included which resembles several versions published in the literature. ZrC is the only phase observed in this system, and like most carbides with a face-centered cubic structure, has a broad solubility range. Eutectic temperatures of 1860 and 2850°C were observed on the zirconium-rich and carbon-rich sides of ZrC, respectively. The data were obtained by high-temperature differential thermal analysis and classical quenching procedures. (auth)

24799 (AEC-tr-5160) NUCLEAR REACTIONS: TWO LECTURES. K. A. Ter-Martirosyan. Translation of "Yadernye Reaktsii, Dve Lektsii." (A publication of the Institute of Theoretical and Experimental Physics, Academy of Sciences, Moscow, 1960). 37p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 21519.

24800 (UCRL-Trans-828(L)) ANGULAR DISTRIBUTION OF PROTONS WITH DIRECT NUCLEAR PHOTO EFFECT. J. Eichler and H. A. Weidenmuller. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Berkeley) from Z. Physik, 152: 261-71 (1958). 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, abstract no. 869.

24801 CONTRIBUTION TO THE TECHNIQUE OF FAST COINCIDENCES AND STUDY OF PROBABILITIES OF E2 TRANSITIONS OF LIGHT NUCLEI. R. Richert. Ann. phys., 6: 1437-92(Nov.-Dec. 1961). (In French)

For measuring the periods of excited levels in light nuclei, a time analyzer capable of intrinsic resolution of 1.3×10^{-10}, Co^{60} resolution of 4.16×10^{-10}, and Na^{22} resolution of 6.4×10^{-10} sec was developed. The results seem to be in agreement with the theory of time resolution of scintillation counters. The periods of the excited levels of B^{10}, Al^{25}, and Al^{26} were measured. The determination of transition probabilities is a very sensitive method for judging the validity of different nuclear models. (J.S.R.)

24802 CONTRIBUTION TO THE THEORETICAL STUDY OF THE EFFECT OF THE COULOMB FIELD IN INTERNAL BREMSSTRAHLUNG ASSOCIATED WITH β DECAY. Robert Vinh Mau. Ann. phys., 6: 1493-1528(Nov.-Dec. 1961). (In French)

An attempt is made to avoid the approximations used previously and to treat in a complete fashion the effects of the nuclear Coulomb field in the internal bremsstrahlung associated with β decay. It is shown that in the transition amplitude a summation over the intermediate states of the electrons including both discrete and continuous spectra occurs. This summation can be avoided by introducing the Green function for the wave equation of an electron in the Coulomb field. The Green function is put in the form of a sum of multiple Dirac operators by scalar radical functions. In an analogous manner, the final wave function of the electron is expressed in terms of Dirac operators acting on a free particle spinor. The transition probability can thus be evaluated by the classical method of traces. Numerical results of the application of these calculations to the case of S^{35} are given. (J.S.R.)

24803 THE DEFORMATION ENERGY OF A CHARGED DROP. IV. EVIDENCE FOR A DISCONTINUITY IN THE CONVENTIONAL FAMILY OF SADDLE POINT SHAPES. Stanley Cohen (Argonne National Lab., Ill.) and W. J. Swiatecki. Ann. Phys. (N. Y.), 19: 67-164(July 1962).

The potential energy of deformation of an idealized, uniformly charged liquid drop is considered. Evidence is discussed for a discontinuous or almost discontinuous behavior of the family of equilibrium configurations of a charged drop (so-called "saddle point shapes") in the neighborhood of a certain critical value of the charge. This evidence, based on several sets of semiquantitative estimates of the deformation energy of a drop, suggests a rapid change in the appearance of the saddle point shapes–from that of two fragments connected by a neck, to that of a cylinder with rounded ends–in a narrow range of charge values. When applied to nuclei this evidence suggests a qualitative change in the properties of fission in that part of the periodic table where the value of Z^2/A is around 35. The physical reason for this behavior of a charged drop is discussed with reference to questions of the stability of spherical and elongated configurations, as well as configurations in which the drop is disintegrated into two or more fragments. The discussion is made with the aid of the concept of "points of bifurcation" in families of equilibrium configurations. One such bifurcation occurs where the conventional symmetric family of saddle point shapes loses stability against asymmetric distortions. This is estimated to take place at a critical charge corresponding to medium weight nuclei with Z^2/A values of about 20 or 25. The significance of this critical region for the definition of fission as a process distinct from "spallation" is discussed. Some of the estimates are made with the aid of the configuration of tangent spheroids. Formulas for evaluating the electrostatic interaction of such spheroids are discussed, and tables of the surface and electrostatic energies (separated into the self-energies of the fragments and their interaction energy) are given for equal and unequal spheroids with various eccentricities. (auth)

24804 NEUTRON ANGULAR DISTRIBUTIONS FROM THE REACTION $Be^9(\alpha,n)C^{12}$ AT 14.1 Mev. J. Kjellman and A. Nilsson (Research Inst. of National Defence, Stockholm and Nobel Inst. of Physics, Stockholm). Arkiv Fysik, 20: 507-15(1962). (In English)

The angular distributions of the neutrons to the ground state and the first, second, and third excited states in C^{12} from the reaction $Be^9(\alpha,n)C^{12}$ are measured at a bombarding energy of 14.2 Mev. The target thickness is ≈250 kev for this α energy. The time-of-flight technique is used with an 80-cm cyclotron. All four distributions show a pronounced backward peaking, which might indicate a direct interaction of the heavy particle stripping type. The excitation energy of the compound nucleus for the used α particle energy corresponds, however, closely to a level at 20.5 Mev found in the $B^{11}(d,n)C^{12}$ reaction, which might increase the probability for compound nucleus formation at this energy. (auth)

24805 MASS NUMBER ASSIGNMENTS AND γ-RAY SPECTRA OF SOME NEUTRON RICH Sn AND Sb ISOTOPES. J. Uhler, G. H. Neumann, O. Melin, and T. Alvaeger (Nobel Inst. of Physics, Stockholm). Arkiv Fysik, 21: 35-48(1962). (In English)

Electromagnetic isotope separations are performed on tin and antimony prepared from fissioned uranium. The samples are studied with regard to their half lives and γ spectra. Information is obtained concerning γ rays. Data are given for Sn^{127}, Sn^{128}, Sb^{127}, Sb^{128}, and Sb^{129}. (auth)

24806 COINCIDENCE STUDIES ON THE DECAY OF Hf^{175}. E. Bashandy, M. S. El-Nesr, and T. Sundstroem (Univ. of Uppsala). Arkiv Fysik, 21: 49-55(1962). (In English)

The decay of Hf^{175} is investigated using electron–electron and electron–gamma coincidence techniques. The existence of 89.3, 113.8, 161.3, 229.6, 318.9, 343.4, and 433 kev transitions is confirmed. It is verified by electron–electron coincidence experiments that the 161.3-kev transition is in coincidence with the 343.4-kev transition. On the basis of coincidence experiments the branching ratios of the transitions are determined. The K-conversion coefficients of the 343.4- and 161.3-kev, as well as the L-conversion coefficients of the 161.3- and 89.3-kev transitions, are measured and found to be in agreement with the theoretical values. (auth)

24807 ON THE DECAY OF Hf^{181}. M. S. El-Nesr and E. Bashandy (Univ. of Uppsala). Arkiv Fysik, 21: 57-63 (1962). (In English)

The decay of 45-day β^- emitter Hf^{181} was studied using an electron-gamma coincidence spectrometer. Gamma rays of energies 476 and 342.3 kev were found to be in cascade with 482- and 615-kev gamma rays, respectively. Beta-gamma coincidence studies indicated that the 482-kev level in Ta^{181} was populated by a beta decay of maximum energy 547 ± 20 kev. A higher beta branch of maximum energy 1045 ± 30 kev was also observed. (auth)

24808 FURTHER STUDIES ON THE DECAY OF Yb^{175}. Ekbal Bashandy and M. S. El-Nesr (Univ. of Uppsala). Arkiv Fysik, 21: 65-9(1962). (In English)

The beta decay of Yb^{175} (4.2 days) was investigated in detail using a medium thick lens magnetic spectrometer and beta-gamma coincidence technique. Four beta groups with maximum energies 73 ± 3, 217 ± 5, 353 ± 5, and 466 ± 3 kev and of relative abundance 10.14 ± 0.42, 0.80 ± 0.12, 2.63 ± 0.21, and 86.52 ± 1.72 percent were determined. A beta branch of maximum energy 217 kev was observed in the Kurie plot obtained from the gross spectrum and verified by the true coincidences recorded between the beta background and the 137.6-kev gamma ray. (auth)

24809 AN ACCURATE COMPARISON OF THE AVERAGE KINETIC ENERGY OF THE FISSION PRODUCTS RESULTING FROM THE FISSIONING OF U^{235} BY THERMAL AND BY 5-Mev AVERAGE ENERGY NEUTRONS. V. N. Okolovich, G. N. Smirenkin, and I. I. Bondarenko. Atomnaya Energ., 12: 461-6(June 1962). (In Russian)

Exact knowledge of the dependence of the kinetic energy E_k on the excitation energy E^* of the fissioning nucleus, especially the experimental measurement of the possible change of the value of E_k in the range above the fission barrier is of great importance for the study of the mechanism of the fission process. Fowler's theory (reported by R. Leachman, Phys. Rev., 101: 1005(1956)) which postulates that the kinetic energy of the fragments is independent from the excitation energy, i.e., from the energy of the neutrons inducing the fission process, was therefore investigated by comparing the average kinetic energies of the fission fragments resulting from fissions induced by fast and thermal neutrons. It was attempted to detect a change of less than 0.1% in the value of E_k at an excitation energy difference of 1 Mev. A system incorporating a grid-type ionization chamber was used for measuring the average kinetic energy, making use of collimators for separating fragments fissioning under a body angle of about 1.7π, together with a 128-channel analyzer for recording the amplitude spectrum. Results showed that within an uncertainty of about 0.1% the value of E_k does not change as the excitation energy E^* is increased up to 5 Mev. The results seem to indicate that the excess energy of the neutron causing the fission is used up to heat the fission fragments. (TTT)

24810 FAST-NEUTRON CAPTURE CROSS SECTION OF CHROMIUM. Yu. Yn. Stavisskiĭ and A. V. Shapar'. Atomnaya Energ., 12: 514(June 1962). (In Russian)

The dependence of the radiative capture cross section of the natural isotopic mixture of Cr on energy was determined by means of the instantaneous γ-radiation, using the T(p,n) reaction taking place in a Van de Graaff accelerator target as the neutron source. Details of the measurement were described previously (Second Conference on Low-Energy Nuclear Physics, 1960). The experimental error of the measurements did not exceed 15% while the neutron energy dispersion amounted to ± 20 kev. Results showed that in the 50 to 1000-kev range the radiative capture cross section of Cr is only slightly dependent on the energy; this may be due to the effect of neutrons having large orbital momentums, the increase of the radiation width, and direct interaction. (TTT)

24811 TOTAL EFFECTIVE NEUTRON CROSS SECTIONS OF As, Se, Sb, AND Te. D. Balli, Z. Georgiu, and T. Stadnikova (Inst. of Atomic Physics of the Rumanian Academy of Sciences, Bucharest). Atomnaya Energ., 12: 514-19(June 1962). (In Russian)

The total cross sections of As, Se, Sb, and Te are at present known only in the energy range higher than 0.01 ev; knowledge of this value at lower energies would allow to estimate the influence of the crystalline structure. A neutron spectrometer provided with a flat, monocrystalline mica was used for the measurements which were carried out in one of the horizontal beamholes of the VVR-S reactor, using BF_3 counters as detectors. Powdered materials were used for the testing. The impurities in Sb consisting primarily of As + Pb amounted to about 1%; they were kept below 0.1% for the other 3 elements. For As, a comparison of the experimental data of the total cross section above 0.006 ev with the theoretical values yielded 3 ± 0.6 barn. The total cross section of Se agreed well with data reported by P. Egelstaff (AERE Report N/R 1147); its scattering cross section in the 0.003 to 0.0045 ev region is equal to about 2 barn. For Te the experimental points lie on the curve obtained from the sum absorption cross section, crystalline cross section, and incoherent cross section. Extrapolation of the theoretical curve to 0.008 ev indicated good agreement with data reported by C. Heindl and L. Ruberman (Phys. Rev., 83: 660(1951)). (TTT)

24812 STUDY AND INVESTIGATION ON THE DISINTEGRATION OF STRONTIUM-82. V. Sangiust (Instituto Di Fisica, Milan). Bol. inform. junta control energia atomica (Peru), 6: 96-104(Nov.-Dec. 1961). (In Spanish)

The x and γ rays which accompany the disintegration and radioactive decay of Sr^{82} were studied. Gamma rays of 775 and 1400 kev were found. With these it was shown that the Rb^{82} decay product of Sr^{82} passes by positron decay not only to the ground state but also to excited levels of Kr^{82}. (tr-auth)

24813 HALF-LIVES OF Cs^{141}, Cs^{142}, AND Cs^{143}. K. Fritze (McMaster Univ., Hamilton, Ont.). Can. J. Chem., 40: 1344-9(July 1962).

The method of timed precipitations was used to measure the half-lives of Cs^{141}, Cs^{142}, and Cs^{143}, which were found to be 24 ± 2 sec, 2.3 ± 0.2 sec, and 2.0 ± 0.4 sec respectively. (auth)

24814 THE RADIOACTIVITY OF TERBIUM-158 AND TERBIUM-157. Mulki Radhakrishna Bhat (Ohio State Univ., Columbus). Dissertation Abstr., 22: 3706(Apr. 1962).

Dysprosium enriched to 0.9% in the mass number 158 was bombarded in the Battelle Reactor for a period of three weeks with an average flux of 5×10^{12} neutrons/cm^2-sec. A chemical separation of the resulting activity was performed and a terbium fraction was obtained. After an elapse of 27 months, during which interval the Tb^{160} initially present in the chemical fraction had disappeared, an examination of the gamma spectrum of the terbium chemical fraction showed gamma rays at energies of 79.7, 182.7, 770, and 950 kev. No gamma ray with an energy higher than 950 kev was observed. A weak gamma ray at an energy of 99.5 kev was also observed. The K x ray emitted by the chemical fraction was identified as that of gadolinium by a comparison with the K x rays emitted by Gd^{153} and Dy^{159}. In order to make a mass assignment to the activity in the terbium chemical fraction, two samples of gadolinium enriched in the mass numbers 158 and 157, respectively, were bombarded with 6-Mev protons, and the gamma spectra of the terbium chemical fraction Gd^{158} + p and Gd^{157} + p were compared. The gamma spectra of these three activities are found to be the same except for the very intense K x-ray peak observed with the chemical fraction. As a further check, the intensity ratios of the 950 and 182.7-kev photopeaks in the Gd^{158} + p and Gd^{157} + p were calculated from a knowledge of the isotopic composition of the enriched gadolinium samples and compared with the experimental values for these intensity ratios. The agreement between the calculated value of 2.7 and the experimental values of 3.1 and 3.6 respectively for the intensity ratios of the 950 and 182.7-kev gamma rays was taken as a confirmation of the assignment of the activity in the terbium chemical fraction to Tb^{158}. A comparison of these two gamma spectra also indicated that there are no gamma rays that could be associated with a long-lived Tb^{157} activity. An examination of the low-energy portion of the gamma spectrum of the chemical fraction also showed an intense L x-ray peak at 6 kev. Unscrambling of the gamma ray spectrum was carried out and after applying corrections for crystal efficiency, internal conversion, and escape of iodine x ray, the following ratios were obtained for the transition probabilities for the activity in the terbium chemical fraction: L x ray : K ray : 79.7 kev γ : 99.5-kev γ : 182.7-kev γ : 770-kev γ : 950-kev γ = 99 : 100 : 5.6 : 0.89 : 0.59 : 0.85 : 3.4. A comparison of the K x-ray intensity of the terbium chemical fraction with that of the Gd^{158} + p activity showed that the K x ray was 120 times as intense in the chemical fraction. The preponderance of the K x-ray intensity in the chemical fraction is ascribed to Tb^{157} activity. Coincidence studies were carried out on the gamma spectrum of the Tb^{158} activity. An energy level diagram for the decay of Tb^{158} was arrived at. In the decay of Tb^{158}, 87% of the decays are found to be due to electron capture and the rest due to beta emission. Tb^{157} is found to decay by L and K capture without the emission of any gamma rays. No positron decay was observed in the case of Tb^{158}.

24815 GAMMA-GAMMA DIRECTIONAL CORRELATION IN TITANIUM-46 (Ti^{46}). Prithvi Chand Lall (Oregon State Univ., Corvallis). Dissertation Abstr., 22: 3708(Apr. 1962).

The gamma-gamma directional correlation in Ti^{46} involving the 1.12 Mev-0.89 Mev cascade was measured at ten angles between 90 and 180° in ten-degree increments with a conventional scintillation spectrometer using NaI (Tl) crystals, differential pulse height analysis, and standard coincidence techniques. The spectrometer was calibrated using the two cascade gamma rays of Ni^{60}. The Ti^{46} source strength was such as to give a true-to-chance coincidence ratio of 4. The experimental results strengthen the assignments (2+) and (4+) to the first and second excited states of Ti^{46} respectively and are consistent with the conclusion that the 1.12 Mev gamma ray is probably pure E2 radiation mixed with less than 0.005% ± 0.002% M3 radiation.

24816 POLARIZATION OF PROTONS IN $C^{12}(d,p)C^{13}$ AND $Be^{9}(d,p)Be^{10}$. Richard Georg Ivar Allas (Washington Univ., St. Louis). Dissertation Abstr., 22: 4376-7(June 1962).

This experiment measures the angular distribution of proton polarization in $C^{12}(d,p)C^{13}$ and $Be^{9}(d,p)Be^{10}$. Since carbon is an example of $l - \frac{1}{2}$ and beryllium of $l + \frac{1}{2}$ capture, the difference of the ($\pm$) can be observed. Some theoretical calculations also exist for both reactions to which experimental results are compared. The 10 Mev deuteron beam from the Washington University cyclotron was focused on the target. The off-coming protons passed through a strong-focusing magnetic quadrupole lens system in order to minimize the neutron flux. After passing through this lens system, the protons were scattered in helium, used as the analyzer, and then detected in nuclear emulsions. Helium was selected as the analyzer because its analyzing properties have been extensively studied, both theoretically and experimentally. The polarization is related to the number of particles scattered symmetrically to the left (L) and right (R) as $P_1 P_2 = (L-R/L+R)$. Here P_1 is the polarization from the stripping process and P_2 is the (known) polarization in the helium scattering. The proton polarization in carbon was found to be negative and that in beryllium positive in the vicinity of the stripping peak as expected from theory. If the negative of the proton polarization in C^{12} is compared with the proton polarization in Be^{9}, the two curves show a great similarity. Both start with small values at small angles, rise to a maximum in excess of $\frac{1}{2}$ at ~ 60°, then drop sharply, change sign, and thereafter rise with sign opposite to that at small angles. The change of sign occurs at angles considerably larger than predicted by Newns and Refai. This indicates that polarization is not primarily due to interference between the main undistorted wave and the distorted waves, but that interaction terms between the various distortions are of the same order of importance. Since the maximum polarization was found to be in excess of the $\frac{1}{2}$ limit predicted by neglecting spin-orbit effects, these effects are of importance when considering polarization. Some calculations of Gibbs indicate, however, that spin-orbit effects predominate at backward angles and have considerably less influence in the vicinity of the stripping peak.

24817 STUDY OF THE Li(p,n) REACTION. Robert Reece Borchers (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 4377(June 1962).

Differential cross sections for the production of neutrons by the proton bombardment of Li were measured for proton

energies from 3.25 to 13 Mev. Targets of metallic lithium were used. The protons were accelerated by a tandem electrostatic accelerator. Relative cross sections were measured and absolute cross sections were obtained by normalization to other measurements. Neutrons were detected by observing proton recoils in hydrocarbon scintillators and spectra were obtained by the pulsed-beam time-of-flight method. The maximum resolution was $(E/\Delta E) = (64/\sqrt{E})$ where E is the neutron energy in Mev and ΔE is the full width at half maximum of a peak produced by monoergic neutrons. The neutron groups to Be^7(g.s.) and Be^7(0.43) were resolved to 10 Mev proton energy. Measurements of the zero degree cross sections were made in 0.25 Mev steps from 3.25 to 10 Mev. The cross section for the ground state group decreases from 45 mb/sr at 3.25 to 35 mb/sr at 4 Mev, and then goes through a maximum of 62 mb/sr at 5 Mev before decreasing to 5 mb/sr at 10 Mev. Full width at half maximum of the peak is about 1 Mev. The zero degree cross section for the neutron group to Be^7 (0.43) increases slowly from 5 mb/sr at 3.25 Mev to a broad maximum of 12 mb/sr at 6 Mev and then decreases to 2 mb/sr at 10 Mev. The zero degree cross sections of the unresolved neutron groups to Be^7(g.s.) and Be^7(0.43) and of the group to Be^7(4.53) were measured at 9, 10, 11, 12, and 13 Mev proton energy. The yield from the first two groups decreases from 9 mb/sr at 9 Mev to 5 mb/sr at 13 Mev. The cross section for production of neutrons to Be^7(4.53) increases from 2 to 3 mb/sr as the proton energy is increased from 9 to 13 Mev. Angular distributions of the ground state and first excited state groups were taken in 0.5 Mev steps from 4 to 10 Mev proton energy at 15° intervals from 0 to 150° in the laboratory. After conversion to the center-of-mass system, the distributions were fitted with a Legendre-polynomial series in cos θ. The cross section for the ground state group showed forward and backward peaking near 5 Mev but became more isotropic at higher energies. Neutron production to Be^7(0.43) was backward peaked near 4.5 Mev but also became isotropic at higher energies. Total reaction cross sections for the two groups were obtained from the coefficients of the polynomial fits to the data. The total cross section for the ground state group has a maximum of 360 mb near 5 Mev and decreased to 50 mb at 10 Mev bombarding energy. This maximum can be accounted for fairly well by postulating a level with $J^\pi = 3^+$ in Be^8 at an excitation of 21.6 Mev formed by l = 1 protons and decaying by l = 1 neutrons to Be^7(g.s.). The total reaction cross section for the group to Be^7(0.43) decreases linearly from 60 mb at 4 Mev to 25 mb at 10 Mev proton energy.

24818 NEUTRON RESONANCES IN INTERMEDIATE NUCLEI. Charles Daniel Bowman (Duke Univ., Durham, N. C.). Dissertation Abstr., 22: 4377-8(June 1962).

The neutron total cross section of separated isotopes of several even A targets near A = 50 was measured with high resolution using the $Li^7(p,n)Be^7$ reaction as the neutron source. The measurements made with a 20° collimator have a neutron energy spread less than 1 kev over most of the energy range from 80 to 650 kev. The measurements on Ca^{40}, Cr^{52}, Fe^{54}, and Fe^{56} are characterized by a number of narrow l > 0 resonances superimposed on much wider l = 0 resonances. The Ti^{46}, Ti^{48}, and Ti^{50} nuclei exhibit a larger proportion of these l > 0 resonances so that the resonance parameters are more difficult to assign. In all the targets, the l = 0 resonance widths are difficult to determine with much accuracy by area analysis because of the strong resonance-resonance and resonance-potential interference. Instead, a multilevel formula obtained from the R-matrix formalism was used to fit the wide s-wave resonances. Fairly good fits to the theoretical distributions of s-wave width and spacing were obtained using the parameters derived from the multilevel fits. By eliminating the well known influence of excitation energy on level spacing, two other major influences on level spacing were isolated: the neutron excess and the subshell effects in the $4f_{5/2}$ subshell. The latter phenomenon, which has been discussed in detail by Rosenzweig, results from the influence of ground state subshell occupation on the level spacing at high excitation energy. The spacings were first normalized to an excitation energy of 6 Mev, to total angular momentum J = 0 and then corrected for the odd-even effect by means of the Bethe-Hurwitz factor. (Data on odd-A nuclei from other sources were included.) The subshell effect was removed from the data by averaging the change in the spacing of isotopic or isotonic pairs and the spacing dependence on neutron excess T was found to be $e^{-T/3.75}$. The data uncorrected for the neutron excess showed little indication of the subshell effect. However, after correcting for the neutron excess the subshell effect was clearly indicated and found to be consistent with the theory if the single particle subshell spacing is taken to be ½ Mev. Attempts were also made to roughly determine the moments of inertia of these nuclei. For these nuclei, which are excited to the neutron separation energy, the values apparently fluctuate widely around the rigid body value but on the average are slightly higher.

24819 BOUND MUON DECAY IN IRON AND ZINC. Lewis Gail Despain (Univ. of Utah, Salt Lake City). Dissertation Abstr., 22: 4378-9(June 1962).

An improved cosmic ray counter consisting of a sandwich array of Čerenkov and scintillation detectors is used to obtain a composite time distribution of decay electrons from positive and negative muons stopping in aluminum, iron, and zinc. The decay electron is detected in an improved toluene scintillation counter capable of absorbing a considerable fraction of the disintegration energy available to the decay electron. The decay time of each muon was measured and electronically converted to a pulse height and then tabulated in the proper time channel by means of a pulse height analyzer. Least squares analysis of the decay data and subsequent manipulation yields the ratio of λ_d, the decay rate for negative muons bound to the target nuclei, to λ_0, the decay rate for free muons. Measurements showed the λ_d/λ_0 ratio to be 1.08 ± 0.07 for iron and 1.01 ± 0.08 for zinc. This experiment offers evidence in support of the anomalous behavior of the λ_d/λ_0 ratio in the region near Z = 26. The ratio of the number of stopping μ^+ to the number of stopping μ^-, was found to be $\rho = 1.17 \pm 0.12$. This value agrees very well with other reported values.

24820 A MEASUREMENT OF THE LONGITUDINAL POLARISATION OF NEON-19 POSITRONS. Jovan Vojislava Jovanović (Washington Univ., St. Louis). Dissertation Abstr., 22: 4380(June 1962).

An experiment whose object is to measure the energy dependence of helicity of positrons emitted from Ne^{19} is described. The positron helicity is measured indirectly by transferring it to the annihilation-in-flight photons, whose transmission through a magnetized iron cylinder is dependent on their polarization. The positron helicity therefore results in a difference of the counting rates for opposed directions of the magnetic field. The measured dependence of this asymmetry with pulse height is compared with a computation which assumes the validity of the two component neutrino theory of beta decay and neglects the depolarization of positrons. A good fit of theoretical curve to the experimental points is obtained for

pulse heights larger than about 1.3 Mev. A strong disagreement is found in the pulse height range between 0.75 and 1.0 Mev, where the experimental asymmetries are much lower than the prediction. Although the influence of the induced pseudoscalar interaction cannot be excluded, it is likely that this discrepancy is produced by the depolarization of positrons due to multiple Coulomb scattering. The measurement of the asymmetry of bremsstrahlung produced in copper by electrons from a $Sr^{90}-Y^{90}$ source is used in order to measure the effective number of aligned electrons in the magnetized iron cylinder. It is assumed, in agreement with measurements performed previously, that the polarization of Y^{90} electrons is equal to $-(v/c)$. By comparison with the bremsstrahlung asymmetries at the higher energy part of the spectrum, the helicity of the Ne^{19} positrons is determined to be $H = (0.97 \pm 0.10)(v/c)$ for positron energies greater than about 1.2 Mev. No conclusion about the positron helicities at lower energies can be obtained until the effect of the depolarization is carefully accounted for.

24821 NEUTRONS FROM DEUTERON BREAKUP ON D, T, AND He^4. Harlan Wayne Lefevre (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 4380(June 1962).

The continuous neutron spectra produced by breakup of deuterons on D, T, and He^4 were studied at deuteron energies near 9 Mev with a fast neutron time-of-flight spectrometer. The instrumental resolution for most of the measurements was $\Delta E/E \simeq 0.06\sqrt{E\ \text{Mev}}$ where ΔE is the full width at half maximum of the resolution function. The spectra were observed down to a neutron energy of about 1 Mev. Energy spread in the incident beam was ~60 kev for observation angles near zero degrees. At angles larger than 30°, the target gas pressure was raised and energy spread was ~270 kev. For the D(d,np)D reaction, spectra were obtained at 0° for bombarding energies of 8 through 11 Mev in 1 Mev steps. Angular distributions of the neutron spectrum were obtained for bombarding energies of 8, 9, and 10 Mev for laboratory angles up to 70°. The results are presented as differential cross sections per unit energy in both the laboratory and center of mass systems. Differential cross sections at zero degrees were obtained by integrating the neutron spectra over energy. The center of mass angular distributions show that the breakup neutrons are peaked forward at all neutron energies. The spectrum shape changes with observation angle; the most probable neutron energy decreases as the center of mass observation angle increases to 90°. For the He^4(d,np)He^4 reaction, spectra were obtained at 0° for bombarding energies of 8, 9, and 10 Mev. Angular distributions of the neutron spectrum were obtained at 9 and 10 Mev. The data from this reaction are presented in the same form as that from the D(d,np)D reaction. Two maxima are present in the 0° spectrum for $E_d = 10$ Mev. The positions of the maxima are consistent with the assumption that He^5 and Li^5 are produced in their ground states as alternative intermediate steps in the reaction. As in the spectra of D(d,np)D neutrons, the center of mass angular distributions are peaked in the forward direction for neutrons of all energies, suggesting a stripping mechanism for the reaction. Neutrons from the T(d,np)T and T(d,2n)He^3 reaction were observed at zero degrees for bombarding energies between 6.7 and 9 Mev. A peak appears in the neutron spectrum from the T(d,np)T reaction at or just below the maximum possible neutron energy from the reaction. The question of whether or not the peak results from an excited state of He^4 at ~20 Mev is discussed but no conclusion is drawn. The data reported are not consistent with an earlier interpretation that the peak was the result of an excited state in He^4 at ~22 Mev.

24822 NEGATIVE MESON ABSORPTION IN LIQUID HYDROGEN. Melvin Leon (Cornell Univ., Ithaca, N. Y.). Dissertation Abstr., 22: 4381(June 1962).

A theoretical study was made of the atomic physics involved in negative meson capture in liquid hydrogen, with the main purpose of setting an upper limit on the fraction of K mesons that react with the proton from the P state. The results placed on a quantitative footing the recent conclusion of Day, Snow, and Sucher (cf. G. A. Snow, Proceedings of the Tenth Annual Conference on High Energy Physics, 1960, p. 407) that nuclear reaction takes place from the high n,S states of the pi or K mesic atoms. The problem involves the rates for the principal mode of deexcitation of the mesic atoms, Auger ionization of neighboring hydrogen atoms; as well as the rates for S state mixing ("Stark mixing"), induced by the electric fields of these neighboring atoms, and the resulting S state absorption by the proton. The Auger rates were calculated in Born approximation for all the appropriate initial and final values of n. The S state mixing and absorption rates, on the other hand, were calculated by an impact parameter method, taking into account both the Stark splitting and the strong interaction energy shift. The resulting cascade time for the pion is compatible with the experimental value, while the desired upper limit for the P state capture of the K meson is less than one percent.

24823 ELASTIC SCATTERING OF PROTONS ON OXYGEN. Stanley Roger Salisbury (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 4382(June 1962).

The differential cross section for the elastic scattering of protons on O^{16} was measured for the laboratory energy range of 4.25 to 8.6 Mev. A differentially pumped gas scattering chamber with a CsI(Tl) scintillation detector was used. Measurements were made at the following center of mass scattering angles: 30°2′, 54°25′, 90°0′, 103°48′, 122°57′, 140°25′, 148°50′, 166° 52′. Measurements were made at 0.0025 to 0.001 Mev intervals with a target thickness of 0.0025 to 0.001 Mev at 166°52′. The other angles were measured at 0.001 to 0.040 Mev intervals with a 0.0011 to 0.0033 Mev target. The energy spread of the beam was less than 0.003 Mev for all the work. The measurements up to 7.6 Mev, plus earlier additional data in the range of 2.0 to 4.25 Mev, were used for a phase shift analysis. The cross section data were fitted to a partial wave phase shift expansion by a least squares method using an IBM 704. The level parameters were obtained by application of dispersion formalism to the extracted phase shifts. The two level approximation was used where appropriate. The analysis covers the range 2.0 to 7.6 Mev, except for 4 levels which were too narrow to be resolved. The parameters for each level are listed below; (the parameters are in the following order: lab. energy in Mev, angular momentum and parity, and ratio of experimental to Wigner limit on reduced width) 4.354 (3/2-), 0.027; 4.787 (3/2+), 0.316; 5.231 (3/2-) 0.006; 5.392 (7/2-), 0.002; 5.402 (1/2+), 0.001; 5.546 (3/2+), 0.028; 5.779 (1/2-), 0.022; 6.332 (1/2+), 0.015; 6.483 (3/2-), 0.0001; 6.564 (3/2+), 0.0004; 6.832 (3/2-), 0.0003; 7.180; 7.280; 7.287; 7.305; 7.313 (3/2+), 0.078; 7.385 (7/2-), 0.006. The approximate resonant energy and laboratory width for the levels above 7.6 Mev which are listed next are only estimated: 7.700, 0.100; 7.875, 0.030; 7.940, 0.030; 8.275, 0.005; 8.310, 0.030. Two appendices are included; the first gives a description of the IBM programs written for this work and a complete fortran listing of the programs.

The second gives two illustrations of branching solutions in the phase shift analysis.

24824 GAMMA-RAY RESONANCE YIELD CURVES FROM ALUMINUM BOMBARDED BY PROTONS AND DIATOMIC HYDROGEN IONS. William LeRoy Walters (Univ. of Wisconsin, Madison). Dissertation Abstr., 22: 4382-3 (June 1962).

Detailed studies were made of the shape of yield curves taken with H_2^+ ions from the $Al^{27}(p,\gamma)Si^{28}$ resonance reaction at 992 kev proton energy. Thick target yield curves revealed new structure which verifies predictions made by Dahl, Costello, and Walters based on a model which takes into account the mutual Coulomb repulsion of the protons after they strike the target. Calculated yield curves agree in general form with experimental results. Discrepancies in details may be due partially to approximations in treatment of internal potential and kinetic energies of the ions. In part these discrepancies are due to neglect of the Lewis effect which is described. New structure was found in thick target yield curves taken with protons from the 992 kev resonance in aluminum. The detailed shape of the yield curves could be reproduced only after a new method of target preparation was developed. Aluminum was slowly and continuously evaporated onto the target while data were being taken. A peak was observed in thick target yield curves at energies somewhat above the resonance energy. This was predicted by H. W. Lewis and is referred to as the Lewis effect. It is caused by the nature of the energy loss process: Protons lose energy due to ionization and excitation of the target material in jumps rather than uniformly as they penetrate the target. Calculated yield curves which take this into account show the Lewis effect and also indicate that previous determinations of resonance energies from thick target yield curves may have been in error.

24825 THEORETICAL MODELS OF ATOMIC NUCLEI. Raymond Starr Willey (Stanford Univ., Calif.). Dissertation Abstr., 22: 4383(June 1962).

The Elliott Model and the P_2 Force. A number of problems are considered which arise when one tries to understand the relation of the shell model of the nucleus to the collective (rotational) model of the nucleus. The Elliott model is a version of the shell model which assumes a central spherical oscillator potential and mixes the various degenerate LS-coupling configurations to obtain a set of wave functions which have certain properties characteristic of the wave functions of the Bohr-Mottelson rotational model. (Elliott, 1958). It is also known that when a residual momentum-dependent quadrupole-quadrupole interaction is added to this model an L(L + 1) rotational spectrum results (Bargmann and Moshinsky, 1960). This development is reviewed and an equivalent momentum-independent residual interaction ('P_2' interaction) is obtained which differs somewhat from the P_2 interaction commonly assumed to give rotational spectra in the model. The model Hamiltonian is separated into a rotational Hamiltonian, a deformed intrinsic Hamiltonian, and a perturbation term. The eigenfunctions and eigenvalues of the intrinsic Hamiltonian are found and used in Inglis' 'cranking model' formula to calculate the moment of inertia. This calculation is of interest because it is not known whether the cranking model calculation correctly gives the moment of inertia of a freely rotating system. It is found that in the limit of very many particles in a shell the correct moment of inertia is obtained. For only a few nucleons in a shell, the values obtained from the formula fluctuate about the correct value. The consequences, for a simple configuration, of modifying the model by taking a mixture of the long range 'P_2' interaction with the short range δ-function interaction are considered. For an intermediate mixture, spectra are found which resemble the spectra predicted by the collective vibrational model. Finally, the implications of a P_2 residual interaction for direct interaction inelastic scattering processes are considered. There are two points of interest here. One is to try and see if one can actually see a P_2 residual interaction in rotational nuclei. The other is to see if the strength of the P_2 interaction obtained from such scattering experiments is consistent with the strength determined from the observed rotational spectrum. Within the approximations made, the few experimental results available seem to be roughly consistent with the calculation. Single-Particle Excitations in Inelastic Scattering of Electrons from Nuclei. Recent experiments of Kendall and collaborators (Cranell, et al., 1961) make it desirable to have more detailed calculations of inelastic electron scattering to resolved final nuclear states than the previous estimates (Schiff, 1954). Walecka (1961) has studied excitations of collective states of the nuclei. A detailed analysis of single-particle excitations is given. The cross section is calculated in relativistic Born approximation in terms of the general longitudinal electric and transverse electric and magnetic multipole operators (Alder, et al., 1956). Using the sums of single-particle operators for the nuclear charge, current, and magnetization densities and single-particle |1 s j) wave functions with harmonic oscillator radial functions, the matrix elements and differential cross sections are calculated for some representative cases. For a $p_{\frac{1}{2}} \rightarrow p_{\frac{3}{2}}$ excitation (corresponding magnetic radiative transition) the M1 contribution is found to be dominant in the sharply forward region and E2 in the sharply backward region. In the experimentally observed range of 40 to 90°, all three (Coulomb, transverse electric, and transverse magnetic) contributions to the cross section are the same order of magnitude. For a $d_{\frac{3}{2}} \rightarrow s_{\frac{1}{2}}$ excitation (corresponding electric radiative transition) the Coulomb contribution dominates in the entire forward direction. In the backward direction, the cross section is a mixture of E2 and M3 terms.

24826 CAPTURE RATES OF NEGATIVE MUONS BY NUCLEI. Prakash Chand and B. K. Agarwal (Univ. of Allahabad, India). Indian J. Phys., 36: 71-6(Feb. 1962).

Using as the radius of nuclear charge distribution $R = 1.2A \times 10^{-13}$ cm, the effective nuclear charge Z_{eff} is calculated employing hydrogen-like wave functions for different nuclei. Substituting these values of Z_{eff} in Primakoff's formula the capture rates of mesons by various nuclei are evaluated. The calculations are in agreement with experimental data. (auth)

24827 EJECTION OF A Li^9-'HAMMER' TRACK. G. C. Deka and K. M. Pathak (Cotton Coll., Gauhati, India). Indian J. Phys., 36: 105-6(Feb. 1962).

A hammer track is described and shown that is interpreted as being produced by the reaction $Li^9 \rightarrow Be^{9*} + \beta^- + \nu$ followed by $Be^{9*} \rightarrow 2\alpha + n$. The angle ($\theta$) of non-collinearity between the α particles is near 35°, whereas if the hammer track were produced by the decay of Li^8 θ could not exceed about 6°. (T.F.H.)

24828 INVESTIGATION ON THE ANGULAR DISTRIBUTION OF PROTONS FROM THE $Al^{27}(\alpha,p)Si^{30}$ REACTION. Bahriye Yaramis (Univ. of Istanbul). Istanbul Univ., Fen Fak. Mecmuasi, Seri. C, 26: 166-80(July-Oct. 1961). (In English)

The angular distribution of protons from $Al^{27}(\alpha,p)Si^{30}$ reactions at 4 Mev is investigated using a 0.2-mc polonium alpha source and 200-μ thick Ilford C2 plates. To ensure enough proton-track population on the plate, 75 days exposure was given; during the exposure, the plates were kept in a box at about 40% relative humidity, using K_2CO_3 as a humidity stabilizer. 7698 protons from ground to ground state transitions and 10330 protons from transitions to the first excited state were counted. Observations were made at 27° to 153° at 2° angular intervals. Observations in each angle were normalized to unit solid angles, such that an isotropic angular distribution is obtained for protons from the ground to ground state transitions, and a symmetrical distribution at 90° in cm coordinates with two peaks at about 45° and at 135° to 140° is obtained for protons from the transition to the first excited state. A Legender polynomial was applied to fit the data, but the angular distribution of the transition to first excited state at lower and higher angles differ from the experimental points. (auth)

24829 SPIN-ORBITAL NUCLEAR INTERACTIONS. Yu. A. Kalade and V. K. Shugurov (Kapsukas Vilnyus State Univ. and Inst. of Physics and Mathematics, Academy of Sciences, Lithuanian SSR). Lietuvos TSR Moksly Akad. Darbai, Ser. B, No. 4, 35-44(1961). (In Lithuanian)

An attempt was made to explain the strong spin-orbit interactions in phenomenological nuclear potentials by considering the postulation on non-euclidian space near nucleons. A variation was found in which the distance metrics larger than one Fermi coincided with the euclidian. The concept of ordinary metrics was applied in calculations of spin-orbital forces at low energies. The experimental deuteron characteristics were used for determining the potential and metric tensor parameters. (tr-auth)

24830 GAMMA RAYS FROM THE B^{10} 5.16 Mev LEVEL NEAR THE (d,n) THRESHOLD. E. K. Warburton and L. F. Chase, Jr. (Lockheed Missiles and Space Co. Research Lab., Palo Alto, Calif.). Nuclear Phys., 34: 517-31(June 1962). (In English)

The γ-ray threshold method was used to establish conclusively that the γ-ray emitting state near 5.2 Mev in B^{10} is the level at 5.159 ± 0.007 Mev associated with the 0.99-Mev neutron threshold in the $Be^9(d,n)B^{10}$ reaction. The partial γ width of this state was determined to be $\Gamma\gamma = (0.7 \pm 0.35)\Gamma$ from a measurement of the (d,n) and (d,nγ) cross sections 50 kev above the threshold for its production. A lower limit to the partial γ width for decay to the 2.15-Mev level in B^{10} of $\Gamma_{\gamma 2.15} > 0.06\Gamma$ was set from the same data. This result, together with data on the $Be^9(p,\gamma)B^{10}$ reaction, establishes that the B^{10} 7.56-Mev level does not decay to the same B^{10} level as that associated with the 0.99-Mev threshold in the $Be^9(d,n)B^{10}$ reaction, so that the 2.40-Mev γ ray emitted by the B^{10} 7.56-Mev level must be a transition to another state near 5.2 Mev in B^{10}. This state may be the 5.18-Mev level of B^{10}, which can be also produced via the $Li^6(\alpha,\gamma)B^{10}$ reaction. (auth)

24831 SCATTERING AND STRIPPING OF 27.0 Mev DEUTERONS ON NITROGEN. H. J. Erramuspe and R. J. Slobodrian (Comision Nacional de Energia Atomica, Buenos Aires). Nuclear Phys., 34: 532-7(June 1962). (In English)

The angular distributions of protons from the reaction $N^{14}(d,p)N^{15}$ and of the elastically scattered deuterons were measured. The experimental results of the first reaction were analyzed in terms of the theory of Butler with undistorted waves. The reaction took place between the ground states of N^{14} and N^{15}, and their spins and parities were known. In order to fit the experimental points it was necessary to superimpose the theoretical curves of $l_n = 1$ and $l_n = 3$, l_n being the orbital angular momentum of the captured nucleon, with interaction radii a = 3.7 fm and a = 3.2 fm. No appreciable contribution from compound nucleus, exchange, or heavy particle stripping processes seemed to be present in the angular distribution. The stripping reduced width was $\Theta^2 = 0.31$. The $l_n = 3$ value of the orbital angular momentum implied the spin flip of the outcoming nucleon. The elastic scattering angular distribution exhibited a typical diffraction structure. Using a simple optical analogy that implied the scattering of waves from a black disk, an interaction radius was calculated for the deuteron-nucleus system: $r_0 = 6.5$ fm. (auth)

24832 DECAY OF ANTIMONY-113. A. P. Patro and B. Basu (Saha Inst. of Nuclear Physics, Calcutta). Nuclear Phys., 34: 538-42(June 1962). (In English)

The decay of Sb^{113} is studied with scintillation beta and gamma spectrometers. The nucleus decays both by positron emission and electron capture. The half life is determined to be 6.4 ± 0.5 min. Gamma rays at 320, 510 (annihilation), 1030, and 1520 kev are found. In addition there are several other weak gamma rays. The analysis of the positron spectrum shows the presence of two positron groups with end-energies of 2.44 ± 0.10 and 1.85 ± 0.10 Mev. On the basis of the beta and gamma energies a tentative level scheme is proposed. (auth)

24833 TRITON MATRIX ELEMENTS OF THE QUADRATIC LS OPERATOR. G. H. Derrick (Univ. of New South Wales, Kensington, Australia). Nuclear Phys., 34: 543-50 (June 1962). (In English)

The matrix elements of the quadratic LS operator are calculated for the total angular momentum and isobaric spin functions of the triton. (auth)

24834 PHOTODISINTEGRATION OF NITROGEN. A. P. Komar, Ya. Krzhemenek, and I. P. Yavor (Inst. of Physics and Tech., Leningrad). Nuclear Phys., 34: 551-61 (June 1962). (In English)

Using a cloud chamber the photodisintegration of N^{14} was studied with γ bremsstrahlung radiation with $E_{\gamma max} = 90$ Mev. Photonuclear reaction yields and integral cross sections of the (γ, p), (γ, n), and (γ, np) reactions, as well as the total cross section, were determined. The energy and angular distributions of protons and neutrons obtained for the (γ, p), (γ, n), and (γ, np) reactions were discussed and compared with calculations. Certain details of the (γ, np) reaction mechanism were given. (auth)

24835 PHOTONUCLEAR REACTIONS WITH DEUTERON EMISSION. V. P. Chizhov, A. P. Komar, L. A. Kulchitskii, A. V. Kulikov, E. D. Makhnovskii, and Yu. M. Volkov (Inst. of Physics and Tech., Leningrad). Nuclear Phys., 34: 562-79(June 1962). (In English)

Photoreactions induced by bremsstrahlung with values of $E_{\gamma max}$ from 30 to 90 Mev, resulting in the emission of deuterons in a broad energy interval, are described. The relative photodeuteron yield is measured as function of the nuclear mass number and the particle energy for a fixed value of $E_{\gamma max}$ and also as function of $E_{\gamma max}$. The angular distributions of the photodeuterons and the excitation function for the (γ, d) reaction are studied. Consideration is given to some possible mechanism of the photodeuteron emission reaction. It is shown that the cross section for the (γ, d) reaction has an appreciable magnitude only for γ energies exceeding the energy threshold of the reaction with the emission of a single deuteron by approximately the nucleon binding energy in the residual nucleus. (auth)

24836 THE BETA DECAY OF Sc^{41}. John G. Cramer, Jr. and C. M. Class (Rice Univ., Houston, Tex.). Nuclear Phys., 34: 580-7(June 1962). (In English)

The beta decay of Sc^{41} is investigated with a scintillation spectrometer. The values obtained for the end point energy and half life are 5.61 ± 0.100 Mev and 0.55 ± 0.03 sec respectively, leading to a ft-value for the Sc^{41}-Ca^{41} transition of 2800. (auth)

24837 DECAY OF Nb^{94} AND Nb^{94m}. L. I. Yin, R. E. Sund, R. G. Arns, and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Nuclear Phys., 34: 588-92(June 1962). (In English)

Gamma rays in Mo^{94} following the decay of Nb^{94} are studied using coincidence and directional correlation measurements. The 700-kev transition is found to be in coincidence with the 873-kev gamma ray. The intensity of the crossover transition of 1573 kev is found to be less than 0.1% of the 873-kev gamma ray intensity. The directional correlation of the 700-kev – 873-kev cascade is measured and the corrected expansion coefficients found to be A_2 = 0.0965 ± 0.0076 and A_4 = 0.019 ± 0.011. These data indicate spins of 4 and 2 for the 1573- and 873-kev levels respectively. Gamma rays following the decay of Nb^{94m} are studied with proportional and scintillation counters. The conversion coefficient α_K of the 42-kev gamma ray in the decay of 6.6-min Nb^{94m} is measured to be 1600 ± 350 and the branching ratio of the transition from Nb^{94m} to the 873-kev level of Mo^{94} is found to be 0.19 ± 0.03%. The intensity ratio of the 600-kev beta ray to the 1.3-Mev beta ray in the decay of Nb^{94m} is determined to be 3.0 ± 0.6%. These measurements support a spin and parity of 3– for the isomeric state. (auth)

24838 THE HEAVY-PARTICLE-STRIPPING REACTION IN (α,p) REACTIONS. I. THE $C^{12}(\alpha,p)N^{15}$ (GROUND STATE) REACTION. Tsuyoshi Honda (Tokyo Inst. of Tech.) and Haruo Ui. Nuclear Phys., 34: 593-608(June 1962). (In English)

The experimental differential cross section for the $C^{12}(\alpha,p)N^{15}$ (ground state) reaction at large angles is analyzed in terms of the heavy-particle-stripping reaction, from E_α = 16 to 40 Mev. It is shown that the shape of the angular distribution at large angles and the magnitude of the cross section, both of which vary non-monotonically with the energy of an incident alpha-particle, can be explained by the heavy-particle-stripping reaction without introducing any energy-dependent adjustable parameters for $E_\alpha \geq 17$ Mev. In particular, agreement is obtained between the theory and the experiment with respect to the sharp peak appearing in the angular distribution at the backward direction around E_α = 25 Mev. Some discussion is added concerning the importance of the heavy-particle-stripping reaction in the (α, p) reaction, contrary to the case of the (d, p) reaction. (auth)

24839 THE HEAVY-PARTICLE-STRIPPING REACTION IN (α,p) REACTIONS. II. THE Li(α,p) Be AND THE F(α,p) Ne REACTIONS. Tsuyoshi Honda and Haruo Ui (Tohoku Univ., Sendai). Nuclear Phys., 34: 609-22(June 1962). (In English)

The following reactions are analyzed in terms of the heavy-particle-stripping reaction: $Li^6(\alpha, p_0)Be^9$ (ground state), $Li^7(\alpha, p_0)Be^{10}$ (ground state), and $Li^7(\alpha, p_1)Be^{10}$ (1st excited state) at E_α = 30 Mev, and $F^{19}(\alpha, p_0)Ne^{22}$ (ground state), $F^{19}(\alpha, p_1)Ne^{22}$ (1st excited state), and $F^{19}(\alpha, p_2)Ne^{22}$ (2nd excited state) at about E_α = 20 Mev. It is shown that the angular distributions of these three (α, p) reactions for Li nuclei can be explained by the heavy-particle-stripping reaction except for their behavior at small angles. It is further shown that the differential cross sections found at larger angles for the $F^{19}(\alpha, p)Ne^{22}$ reactions are also explained by the heavy-particle-stripping reaction. In particular, agreement is obtained between theory and experiment with respect to the very sharp peak at the backward direction appearing in the differential cross section for the $F^{19}(\alpha, p_0)Ne^{22}$ (ground state) reaction. In this connection, some remarks are added concerning the shell model wave functions calculated for O^{18} and F^{19}. The reduced width extracted from the experimental data of the $F^{19}(\alpha, p_0)N^{22}$ reaction is found to be very small in comparison to that of the $C^{12}(\alpha, p_0)N^{15}$ reaction. (auth)

24840 NEUTRON-CAPTURE GAMMA-RAY SPECTRA OF THE TUNGSTEN ISOTOPES. P. A. Treado and P. R. Chagnon (Univ. of Michigan, Ann Arbor). Nuclear Phys., 34: 623-7(June 1962). (In English)

The spectra of gamma radiation following neutron capture in separated tungsten isotopes are measured with a three-crystal scintillation pair spectrometer and a single-crystal scintillation counter, and with both in coincidence. Energies and intensities of the gamma rays from product nuclei W^{183}, W^{184}, W^{185}, and W^{187}, are reported. From those gamma rays identified as ground-state transitions, the neutron binding energies of these four isotopes respectively are deduced to be 6.10, 7.48, 5.86, and 5.34 Mev. The presence of considerable high-energy structure in each of the spectra indicates that direct capture and/or anomalous resonance capture processes may be of importance. (auth)

24841 ANGULAR DISTRIBUTIONS FOR A RANGE OF Q-VALUES IN $N^{14}(d,p)N^{15}$. V. M. Rout, W. M. Jones, and D. G. Waters (Associated Electrical Industries, Aldermaston, Berks, Eng.). Nuclear Phys., 34: 628-36(June 1962). (In English)

Following a suggestion that the angular distributions from (d,p) reactions at low bombarding energy should show marked stripping characteristics for low Q-values, the reaction $N^{14}(d,p)N^{15*}$ is investigated at a bombarding energy of 2 Mev in the range of excitation covering the first seven excited states, whose Q-values range from 3.3 to 0.3 Mev. The angular distributions of protons from levels below a Q-value of ≈ 1 Mev show stripping characteristics. (auth)

24842 PHOTODISINTEGRATION OF SULPHUR IN THE 30-80 Mev RANGE. G. Bonazzola, O. Borello, S. Costa, and S. Ferroni (Universita, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuclear Phys., 34: 637-43(June 1962). (In English)

A study in the 30 to 80 Mev range of the $S^{32}(\gamma, np)$ P^{30} and $S(\gamma, n)$ reactions is carried out, together with a study of the $C^{12}(\gamma, n)$ C^{11} reaction in the same energy range. (auth)

24843 PRODUCTION OF DEUTERONS IN THE INTERACTION OF FAST NUCLEONS WITH NUCLEI. V. S. Barashenkov and V. M. Maltsev (Joint Inst. for Nuclear Research, Dubna, USSR). Nuclear Phys., 34: 644-7(June 1962). (In English)

A large yield of deuterons in proton-nucleus interactions at energies $T \gg 1$ Bev may be explained by means of peripheral interactions of primary protons with nuclei. In this case deuterons arise as a result of inelastic nucleon-nucleon interactions. (auth)

24844 MEASUREMENT OF THE L/K-CAPTURE RATIO IN ^{51}Cr DECAY. U. Fasoli, C. Manduchi, and G. Zannoni (Universitâ, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10), 23: 1126-8(Mar. 16, 1962). (In English)

Cr^{51} decays by an allowed electron capture transition, with a half life of 27.9 days and an energy of (0.751 ± 0.003)

Mev. The L and K x rays of the daughter V^{51} are studied in a multiwire proportional counter filled with Ar at 2, 4, and 5 atm. The average L/K capture ratio is measured as 0.1026 ± 0.0004. (T.F.H.)

24845 FLUCTUATIONS IN NUCLEAR REACTION CROSS-SECTIONS. A. Agodi, G. Pappalardo, R. Ricamo, and D. Vinciguerra (Università, Catania, Italy). Nuovo cimento (10), 23: 1136-9(Mar. 16, 1962). (In English)

Gross structure is observed in the cross sections for neutron reactions on nuclei with A near 30, when the cross sections are plotted as functions of the neutron energy (between about 2 and 5 Mev). The observed peaks are much more closely spaced than would be the case if they were caused by single compound-nucleus energy levels. An explanation is offered for the observed phenomenon, based on statistical fluctuations in the compound-nucleus energy-level density near a given neutron energy. In order to observe the structure in question, measurements must be carried out with a resolution on the order of 100 kev. (T.F.H.)

24846 REACTION $^{28}Si(n,\alpha)^{25}Mg$ FOR 14.6 Mev NEUTRONS. D. Blanc (Université, Toulouse, France), F. Gambou, D. Devillers, H. Rème, G. Vedrenne, and G. Ambrosino. Nuovo cimento (10), 23: 1140-3(Mar. 16, 1962). (In English)

A Si detector is exposed to 14.6-Mev neutrons, and (n,p) and (n,α) reactions occur on the Si^{30}, Si^{29}, and Si^{30} nuclei in the detector. It is noted that the isotopic abundances and cross sections render all the reactions negligible except $Si^{28}(n,\alpha)Mg^{25}$. The α spectrum between 7 and 13 Mev from this reaction is shown and correlated to the energy levels of the residual Mg^{25} nucleus. The cross sections for excitation of individual excited states of Mg^{25} are discussed. It is noted that the Mg^{25} recoiling nucleus is detected by the Si detector with an efficiency equal to the α detection efficiency. (T.F.H.)

24847 AN ITERATION METHOD FOR CONNECTED GRAPHS. M. Wellner (Indiana Univ., Bloomington). Nuovo cimento (10), 24: 913-19(June 1, 1962). (In English)

The set of connected time-ordered Green's functions (ρ functions) for a self-interacting neutral scalar field is considered. The exact equations linking them will, upon insertion of a trial set $\rho^{(0)}$ of ρ functions, produce an improved set, thus yielding an iteration process. A possible form of $\rho^{(0)}$ derived from an exact solution of the classical field problem is discussed. (auth)

24848 ALPHA PARTICLES FROM THE PROTON BOMBARDMENT OF ALUMINIUM. S. L. Andersen, A. Haug, T. Holtebekk, O. Loensjoe, and R. Nordhagen (Univ. of Oslo, Blindern, Norway). Phys. Norvegica, 1: 7-19(1961). (In English)

The reaction $Al^{27}(p,\alpha)Mg^{24}$ ground state was studied in the proton energy region from 730 to 1390 kev. The following resonances in the reaction $Al^{27}(p,\gamma)Si^{28}$ were observed also to yield α particles: 731, 884, 922, 936, 1002, 1182, 1212, 1261, 1274, 1315, and 1387 kev. At 1363.2 ± 0.4 kev a new α-emitting resonance was found yielding γ rays of very low intensity. The angular distributions of the α particles from the stronger resonances were obtained, and the following values for the resonant level spins and parities were established: at 936 kev 2^+ or 3^-, at 1182 kev 2^+, at 1315 kev 4^+, at 1363 kev 2^+, and at 1387 kev 2^+ or 3^-. Absolute yields are found. The dimensionless reduced widths for the resonant level at 1182 kev are $\theta_\alpha^2 = 0.055$ and $\theta_p^2 = 0.003$ (s-wave). For some other levels limits for partial widths and dimensionless reduced widths are given. (auth)

24849 HYPERFINE STRUCTURE OF THE ^3P STATES OF Zn^{67} AND Mg^{25}. Allen Lurio (International Business Machines Corp., New York). Phys. Rev., 126: 1768-73 (June 1, 1962).

The hyperfine structure of the metastable (4s4p) $^3P_2$ state of Zn^{67} and the metastable (3s3p) $^3P_2$ and $^3P_1$ states of Mg^{25} were measured by the atomic beam magnetic-resonance technique. The magnetic dipole and electric quadrupole-coupling constants are: $Zn^{67}(^3P_2)$, A = 531.987 ± 0.005 Mc/sec, B = 35.806 ± 0.005 Mc/sec; $Mg^{25}(^3P_2)$, A = −128.445 ± 0.005 Mc/sec, B = 16.009 ± 0.005 Mc/sec; $Mg^{25}(^3P_1)$, A = −144.977 ± 0.005 Mc/sec, B = −8.308 ± 0.005 Mc/sec. These results are compared with the theory of two-electron hyperfine structure. The electric quadrupole moments of these nuclei are: $Q(Zn^{67}) = 0.16 \times 10^{-24}$ cm^2, $Q(Mg^{25}) = 0.22 \times 10^{-24}$ cm^2. The quadrupole moment of Mg^{25} agrees with that value obtained using the collective model in strong coupling. The detection of a beam of metastable $^3P_1$ Mg atoms places a lower limit on the lifetime of this state of about 10^{-3} sec. (auth)

24850 OPTICAL DETECTION OF LEVEL CROSSING IN THE (5s5p) $^3P_1$ STATE OF Cd^{111} AND Cd^{113}. P. Thaddeus and R. Novick (Columbia Univ., New York). Phys. Rev., 126: 1774-80(June 1, 1962).

The magnetic field at which crossing occurs for the $|F,m_F\rangle = |\frac{3}{2},\frac{3}{2}\rangle$ and $|\frac{1}{2},-\frac{1}{2}\rangle$ hyperfine levels of the (5s5p) $^3P_1$ state of Cd^{111} and Cd^{113} was measured to high precision by observing the change in intensity, at an angle of 90°, of the resonance fluorescence of the 3261 Å intercombination line. The measured crossing fields, in units of the nuclear magnetic resonance frequency of protons in mineral oil, are $H_c^{111} = 8363.408(30)$ kc/sec, $H_c^{113} = 8748.734(20)$ kc/sec. From these results and the known values of the (5s5p) $^3P_1$ hyperfine interval for the two isotopes, the Lande g_J factor for this state is $g_J^{111} = \frac{3}{2} - 160(9) \times 10^{-6}$, $g_J^{113} = \frac{3}{2} - 146(9) \times 10^{-6}$. These results include corrections for second-order interaction with the adjacent fine-structure levels of the 5s5p configuration. (auth)

24851 HEAVY-PARTICLE STRIPPING AND THE STRUCTURE OF N^{14}. D. R. Inglis (Argonne National Lab., Ill.). Phys. Rev., 126: 1789-94(June 1, 1962).

A qualitative explanation is found for the contrast observed between the angular distributions of the groups going to the ground state and the second excited state in the reaction $C^{13}(Li^6,\alpha)N^{14}$. The ground-state group of alphas has a peak only in the backward direction because only the mechanism of "heavy-particle stripping" can satisfy the requirements on the orbital angular momentum for the ground state of N^{14} (primarily a ^3D). The "deuteron" of the incident Li^6 initially has insufficient angular momentum about the final core but acquires more because the force attracting it toward the target nucleus is not directed toward the center of mass of the twelve nucleons (eight from the target C^{13} and four from Li^6) which form the core of the final N^{14}. The other four nucleons from the target form the product alpha. The second excited state of N^{14} is approximately a ^3S and there is no such angular momentum limitation, so both light- and heavy-particle stripping occur and give rise to forward and backward peaks. The validity of the cluster model for Li^6 is discussed. (auth)

24852 LOW-ENERGY NEUTRONS FROM THE REACTION $Be^9(\alpha,n)C^{12}$. F. A. St. Romain, T. W. Bonner, R. L. Bramblett, and J. Hanna (Rice Univ., Houston, Tex.). Phys. Rev., 126: 1194-7(June 1, 1962).

Experiments carried out on the detection of slow neutrons from the (α,n) reaction in Be^9 show an increasing number of low-energy neutrons at 4.3 to 5.6 Mev. The energies and

angular distribution of these neutrons for E_α = 4.92 and 5.11 Mev were measured using the polyethylene sphere-moderated neutron spectrometer. Results indicate a peaking in the forward direction and an energy distribution consistent with their origin from inelastic alpha scattering leaving Be^9 excited to the level at 1.75 Mev, which subsequently breaks up with neutron emission. At 5.11 Mev, the mean energy of these neutrons and the differential cross sections are: 0°(0.33 Mev, 22 mb/sr); 70°(0.21 Mev, 8 mb/sr); and 120°(0.07 Mev, 2 mb/sr). The neutron spectrum of a Pu-Be source has a large number of low-energy neutrons having a peak intensity at 0.3 Mev. (auth)

24853 APPLICATION OF RECOIL TECHNIQUES TO STUDY OF THE REACTIONS $Ra^{226}(\alpha,4n)Th^{228}$, $Pb^{208}(\alpha,2n)Po^{210}$, AND $Pb^{207}(\alpha,n)Po^{210}$. John R. Morton, III and Bernard G. Harvey (Univ. of California, Berkeley). Phys. Rev., 126: 1798-1804(June 1, 1962). (UCRL-9595-Rev.11)

The ranges and angular distributions of the recoiling residual nuclei from the systems $Ra^{226}(\alpha,4n)Th^{228}$, $Pb^{208}(\alpha,2n)Po^{210}$, and $Pb^{207}(\alpha,n)Po^{210}$ were examined to obtain information about the reaction mechanisms. The experimental angular distributions were compared with distributions calculated by a Monte Carlo method based upon the compound nucleus and statistical models. The results from the $Ra^{226}(\alpha,4n)$ reactions agree with the calculations; the $Pb^{208}(\alpha,2n)$ and $Pb^{207}(\alpha,n)$ data require substantial contributions from direct-interaction mechanisms. (auth)

24854 SPALLATION-FISSION COMPETITION IN ASTATINE COMPOUND NUCLEI FORMED BY HEAVY-ION BOMBARDMENT. T. Darrah Thomas, Glen E. Gordon, Robert M. Latimer, and Glenn T. Seaborg (Univ. of California, Berkeley). Phys. Rev., 126: 1805-10(June 1, 1962). (UCRL-9950)

Cross sections for neutron-evaporation reactions from compound nuclei produced by bombardment of gold with carbon ions and of platinum with nitrogen ions were determined. The magnitudes of the cross sections are considerably lower than would be predicted on the assumption that neutron emission is the only important mode of decay of the intermediate nuclei. This is explained on the basis of fission competition with neutron emission. To a lesser extent, charged-particle evaporation is also a competing mode of decay. It is indicated that fission occurs with comparable magnitudes in several nuclei in the neutron-evaporation chain or in one or two nuclei near the end of the chain, rather than predominantly in the initial compound nucleus. Problems arising from the possible existence of isomers in the odd-odd astatine nuclides are discussed. (auth)

24855 LIFETIMES OF THE FIRST EXCITED STATES OF C^{15} AND B^{10}. J. Lowe, C. L. McClelland and J. V. Kane (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 126: 1811-18(June 1, 1962).

The lifetimes of the first excited states of C^{15} and B^{10} were measured using a pulsed Van de Graaff beam, with a slanted-target technique to reduce the duration of beam pulses on the target. The mean lives of these levels are (0.73 ± 0.23) nanosec for C^{15}, and (1.04 ± 0.02) nanosec for B^{10}. This result for C^{15}, together with gamma angular distribution and stripping measurements, confirms the spin and parity of the first excited state of C^{15} as $\frac{5}{2}$+. (auth)

24856 POSITRON EMISSION IN THE DECAY OF K^{40}. D. W. Engelkemeir, K. F. Flynn, and L. E. Glendenin (Argonne National Lab., Ill.). Phys. Rev., 126: 1818-22 (June 1, 1962).

Positron emission was detected in the decay of K^{40} in a triple coincidence experiment using a liquid-scintillation positron detector and two NaI(Tl) annihilation gamma detectors. A ratio of $\beta^+/\beta^- = (1.12 \pm 0.14) \times 10^{-5}$ was found. This corresponds to a radio of the squared matrix elements of $M_+^2/M_-^2 = 0.18 \pm 0.03$ which is in substantial agreement with a theoretical estimate of $\frac{1}{4}$. The effect of this result on the decay constants of K^{40} is discussed. (auth)

24857 PHOTOPROTON REACTION IN Be-9. F. M. Clikeman, A. J. Bureau, and M. G. Stewart (Ames Lab., Ames, Iowa). Phys. Rev., 126: 1822-5(June 1, 1962). (IS-357)

The reaction $Be^9(\gamma,p)Li^8$ was measured at 16.89 to 57 Mev using the bremsstrahlung beam from an electron synchrotron. The data were taken in energy steps of ~0.050 Mev for the first several Mev and in energy steps of ~1.0 Mev for the remainder of the yield curve. Small resonances near threshold were observed. The giant resonance cross section reaches a peak of 2.64 ± 0.30 mb at 23 Mev and possesses a large high-energy tail. The integrated cross section to 56.8 Mev is 41.4 ± 4.6 Mev-mb. (auth)

24858 PARTICLE PRODUCTION AT LARGE ANGLES BY 30- AND 33-Bev PROTONS INCIDENT ON ALUMINUM AND BERYLLIUM. V. L. Fitch, S. L. Meyer, and P. A. Piroué (Princeton, N. J.). Phys. Rev., 126: 1849-51(June 1, 1962).

A mass analysis has been made of the relatively low-momentum particles emitted from Al and Be targets when struck by 30- and 33-Bev protons. Measurements were made at 90°, 45°, and $13\frac{1}{4}$° relative to the direction of the Brookhaven AGS proton beam. Magnetic deflection and time-of-flight technique were used to determine the mass of the particles. (auth)

24859 SPALLATION OF COPPER WITH 24-Gev PROTONS. G. Rudstam, E. Bruninx, and A. C. Pappas (CERN, Geneva). Phys. Rev., 126: 1852-7(June 1, 1962).

Yields of spallation products from irradiation of copper by 24-Bev protons were measured. A comparison with results at lower energies shows that the cross-section distribution of the spallation products hardly changes above 1 Bev. (auth)

24860 LORENTZ INVARIANCE AND THE KINEMATIC STRUCTURE OF VERTEX FUNCTIONS. Loyal Durand, III (Brookhaven National Lab., Upton, N. Y. and Yale Univ., New Haven), Paul C. DeCelles, and Robert B. Marr. Phys. Rev., 126: 1882-98(June 1, 1962). (BNL-5923)

The general kinematic properties of vertex functions which follow from the transformation properties of the initial and final single-particle states, and of the vertex (current) operator under proper and improper Lorentz transformations, are studied for the pseudoscalar (pion) and vector (electromagnetic) vertices. The treatment, which relies strongly on the helicity representation for the states of a relativistic particle introduced by Jacob and Wick, is fully relativistic, and applies to particles of arbitrary spin. The number of independent vertex functions or form factors is determined in each case, and the analogs of the nonrelativistic multipole expansions are obtained. A complete specification of the dependence of the matrix elements on the spins, helicities, and relative parities of the particles and information on the limiting behavior of the form factors for small momentum transfers are obtained. A theorem that the matrix elements of the 4-divergence of the electromagnetic current between states of the same (single) particle vanish independently of the assumption of gauge invariance or current conservation, is extended to the case of arbitrary spin and to any vector current having the same transformation properties as j_μ. Parametrizations obtained for the pseudoscalar and vector vertex func-

tions are used to calculate the cross sections for the general two-particle scattering process a + b → c + d in the single-quantum-exchange approximation for relativistic particles of arbitrary spin. (auth)

24861 CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS. THE ISOTOPIC EFFECT OF SECONDARY REACTIONS OF RECOIL ATOMS ACCOMPANYING THE (n,γ) PROCESS. E. S. Filatov. Uspekhi Khim., 31: 752-68 (June 1962). (In Russian)

Synthesis of new compounds by exposure to a neutron flux of a reactor received great impetus recently; in particular, the (n,γ) reaction presents a relatively simple method for preparing the radioactive isotopes of the starting materials. The recently established existence of a differential behavior of isotopes spurred research on the effect of recoil atoms. This "isotopic effect" may be due to dissimilarity in the kinetic energy caused by emission of γ quanta after neutron capture or to the difference in the energy state of the electron shells of the recoil atoms. The yield of the labeled organic products in the solid phase increases with decreasing initial recoil energy, reportedly because the local concentration of the molecular fragments increases, favoring the recombination of the fragments into new compounds. The effect was not observed by others however, and was thus designated as the "apparent isotopic effect." In the case of certain vitreous and crystalline materials the effect of diffusion reactions also may play a role. Processes taking place during heat treatment of materials exposed to γ rays, neutron, proton, or other particular radiation was also intensively investigated. The effect of the chemical composition of the recoil atoms on the subsequent reactions are considered for the case of the reaction of tritium and methane. The isotopic effect of "hot" Br atoms, Br^{82} and Br^{80m} activated by (n,γ) reaction is also reviewed. Reaction kinetics, reactivity, radiation, and high temperature chemistry problems are involved in the explanation of the theory of "hot atoms." (TTT)

24862 INVESTIGATION ON FORM FACTORS FOR ELASTIC AND INELASTIC ELECTRON-NUCLEI SCATTERING. Rudolf Rodenberg (Universität Tübingen, Ger.). Z. Naturforsch., 17a: 360-1(Apr. 1962). (In German)

Equations describing the reciprocal effects between the nucleus and electrons, nucleus and field, and electrons and field are given. Matrix elements were determined for scattering of free electrons. The form factors were derived from Dirac equations (M.C.G.)

24863 RELATION OF THE EFFECTIVE CROSS SECTIONS FOR INELASTIC ELECTRON TO INELASTIC POSITRON SCATTERING ON THE ATOMIC NUCLEUS. Rudolf Rodenberg (Universität Tübingen, Ger.). Z. Naturforsch., 17a: 438-9(May 1962). (In German)

Electron and positron inelastic scattering on nuclei was studied. The dependence on energy and atomic weight of the nucleus and the influence of the finite extent of the nucleus in positron annihilation with shell electrons were determined. (M.C.G.)

24864 THE SPECTRA OF PHOTONEUTRONS FROM THE REACTIONS $C^{12}(\gamma,n)C^{11}$ AND $O^{16}(\gamma,n)O^{15}$. H. Fuchs, D. Haag, K. H. Lindenberger, and U. Meyer-Berkhout (Universität Heidelberg, Ger.). Z. Naturforsch., 17a: 439-41 (May 1962). (In German)

Photoneutron energy spectra and yields from carbon and oxygen were measured using 31 Mev bremsstrahlung. The neutrons were detected via the recoil protons in a stilbene crystal. The energy spectrum of the photoneutrons from the $O^{16}(\gamma,n)$-reaction showed pronounced structure. (auth)

Particle Accelerators

Refer also to abstract 23976.

24865 (CERN-62-3) THE CERN PROTON SYNCHROTRON. (3rd Part). E. Regenstreif (European Organization for Nuclear Research, Geneva). Jan. 8, 1962. 239p.

The magnetic power supply, vacuum system, controls, and geodetic problems are thoroughly analyzed for the CERN proton synchrotron. (N.W.R.)

24866 (JINR-P-914) OB ODNOM METODE USKORENIYA ELEKTRONOV V KOL'TSEVOM FAZOTRONE. (On a Method of Electron Acceleration in an Annular Synchrocyclotron). A. A. Zhuravlev. V. I. Kotov, E. A. Myae, and V. A. Oboznyi (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1962. 11p.

Induction of electron acceleration in an annular synchrocyclotron by combining a vortex electric field with a constant high-frequency field is described. The obtained experimental data are correlated with theoretical. (tr-auth)

24867 (JINR-P-962) ELEKTRONNAYA ZAGRUZKA REZONATORA TSIKLOTRONA. (Electron Load of Cyclotron Resonator). B. A. Zager, G. Indreash, V. G. Tishin, and I. A. Shelaev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1962. 11p.

The electron load of the resonator observed in the Y-300 and Y-150 cyclotrons accounts for the appearance of an avalanche of electrons oscillating between the dee edges. A mechanism for this phenomenon is described, and some measures are suggested for decreasing resonator loading and reducing the duration of accelerator training. (auth)

24868 (TID-16053) IN-LINE CALORIMETER FOR MICROWAVE POWER MEASUREMENTS. M. Michael Brady (Stanford Univ., Calif. Stanford Linear Accelerator Center). Mar. 1962. Contract AT(04-3)-363. 47p. (M-295)

The static in-line calorimeter measures the temperature rise in the walls of a waveguide caused by the attenuation of microwave power flowing through the waveguide. It can be constructed so that it will fit on waveguide already existing in a microwave system. The device is reliable because it uses no active circuitry. Few mechanical problems are encountered because the existing waveguide need not be altered. If a section of waveguide is thermally insulated and provided with heat sinks at both ends, then the center temperature rise is directly proportional to the average waveguide power level. The temperature level attainable for a given length of waveguide is a function of the physical properties of the waveguide material and the square of its length. The rise time of such an in-line calorimeter is also dependent on the square of the length and can be fairly well described by a single exponential. If an in-line calorimeter is made an integral number of waveguide wavelengths long, it is insensitive to standing-wave patterns in the waveguide and will simply read the sum of the incident and reflected powers. Two experimental S-band calorimeters using stainless steel waveguide and resistance-wire bridge temperature indicators are described. The measured sensitivity and time constant for both units falls within the experimental error of confirming the theoretically predicted figures. (auth)

24869 (AERE-Trans-890) A METHOD FOR PREVENTING RESONANCE DISCHARGE IN A CAVITY RESONATOR BY MEANS OF A MAGNETOSTATIC FIELD. A. Massarotti and A. Turrin (Italy. Comitato Nazionale per le Ricerche Nucleari. Frascati Laboratori). Trans-

lated by S. Pease (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from report CNEN Nota Interna No. 59. Nov. 25, 1961. 12p.

The possibility is examined of avoiding the resonance discharge in a cavity resonator whose gap is under vacuum by means of a magnetostatic field. The problem is stated for excitation of the cavity RF_2 by 150 kv. (J.R.D.)

24870 (UCRL-Trans-816) CONFIGURATION OF THE DESY MAGNET. Werner Hardt (Deutsches Elektronen-Synchrotron, Hamburg). Translated for Univ. of California Lawrence Radiation Lab., Berkeley from report DESY-A1.5. June 8, 1959. 69p. (Includes original, 39p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract no. 18185.

24871 (UCRL-Trans-843) INVESTIGATION OF THE CHARACTERISTICS OF THE BEAM OF PROTONS ACCELERATED IN THE 10 Bev SYNCHROPHASOTRON. A. B. Kuznetsov and K. P. Myznikov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). Translated by D. A. Nimidoff (Univ. of California Lawrence Radiation Lab., Berkeley) from report JINR-P-787. 1961. 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 6034.

24872 DESIGN OF THE 7-Bev PROTON SYNCHROTRON. V. V. Vladimirskiĭ, E. G. Komar, A. L. Mints, L. L. Gol'din, N. A. Monoszon, S. M. Rubchinskiĭ, E. K. Tarasov, A. A. Vasil'ev, F. A. Vodop'yanov, D. G. Koshkarev, V. S. Kurÿshev, I. F. Malÿshev, A. M. Stolov, N. S. Strel'tsov, and B. M. Yakovlev. Atomnaya Energ., 12: 472-4(June 1962). (In Russian)

Work on the 7-Bev proton synchrotron which represents the first circular accelerator with strong focusing built in the Soviet Union, was started in 1953. In order to establish the feasibility of this machine, resonance phenomena at betatron frequencies, phase motion of the particles, theoretical problems connected with the injection and scattering of protons were studied while carrying out calculations on the desired field configuration and on electronics problems. Instead of attempting to optimize the weight of the magnets, the parameters were chosen as to make the system adaptable for many purposes. The magnetic system included 14 quadrupole magnets with negatively bent orbits having curvatures twice smaller than the other magnets. A 4-Mev electrostatic generator was used as injector; in view of this low injection energy the dimensions of the chamber were made larger than necessary. The acceleration was carried out at the 7th harmonic of the revolution frequency. The acceleration was carried out at the 7th harmonic of the revolution frequency. The main assembly was completed at the beginning of 1961 at which time the beam experiments were started. A proton energy of 7.2 Bev was reached at an intensity of 3 to 5 . 10^9 particles/pulse. By November the internal target unit was placed in position. (TTT)

24873 ACCELERATORS WITH A VERTICALLY INCREASING FIELD. Yu. Teikhman (Inst. of Vacuum Electronics of the Czechoslovak Academy of Sciences, Prague). Atomnaya Energ., 12: 475-82(June 1962). (In Russian)

Repeated tests with classic accelerators with a plane of symmetry indicated that the requirements of the constancy of the controlling and focusing fields and the independence of the betatron and orbiting frequencies of the particles cannot be fulfilled simultaneously; for this reason accelerators were designed with vertically increasing fields, having symmetries with respect to several rotational surfaces. Whenever the energy of these devices is increased, the equilibrium orbits are shifted toward the surface of symmetry in the direction of the axis to areas of higher field strength. Such a device possessing a vertically increasing field is very useful for accelerating electrons to high energies. The vertical shift of the orbits upon increasing the energy is the most important feature of this class of accelerators. The rate of the shift decreases exponentially, together with the particle density of the beam. Thus, very high current densities may be obtained in the last orbits; this is limited only by interaction within the beam. Radiative losses may be compensated by the high-frequency field. (TTT)

24874 PHASE CONDITIONS IN SYSTEMS WITH A BUILDUP OF HIGH ACCELERATED-PARTICLE FLUXES. S. S. Shakhidzhanov. Atomnaya Energ., 12: 483-7(June 1962). (In Russian)

Study of the accumulations of high fluxes of accelerated particles is of great interest for determining the behavior of opposite beams and for establishing the conditions required for creating a stabilized relativistic beam. The builtup flux of charged particles is ultimately contained in a constant magnetic field, compensating for the radiation losses by means of the accelerating high-frequency voltage which divides the beam into separate clusters. There is an important reverse effect of the cluster on the accelerating resonator, resulting in the reconstitution of the system. These undesired phenomena may be counteracted by disturbing the accelerating resonator of the high-frequency generator and compensating for the a-c current created by the cluster of accelerated particles. Further considerations showed that at sufficiently high flux levels the phase oscillations of the clusters of accelerated particles become unstable; the instability criteria were mathematically derived. This loss of the stability of the clusters must be taken into account in the design of high-frequency buildup systems. (TTT)

24875 VARIABLE FREQUENCY ELECTRON BEAM GROUPING. E. D. Gazazyan and E. M. Laziev (Inst. of Physics, Academy of Sciences, Armenian SSR). Izvest. Akad. Nauk Armyan. S.S.R., Ser. Fiz.-Mat. Nauk, 15: No. 2, 173-9(1962). (In Russian)

Characteristics of a variable-frequency buncher with two resonators excited at ω_1 and $k\omega$ frequencies, respectively, are analyzed on the basis of kinematic theory. It is shown that the buncher is capable of producing sufficiently narrow electron beam bunches. Harmonic analysis of the buncher current shows the presence of high harmonics (~800) for the ω_1 frequency. (R.V.J.)

24876 FOCUSING PROPERTIES OF CYCLOTRON WITH SECTIONED MAGNET SYSTEM. J. Lembra (Tartu State Univ., USSR). Izvest. Akad. Nauk Eston. S.S.R., Ser. Fiz. Mat. i Tekh. Nauk, No. 1, 50-8(1962). (In Russian)

An envelope method is used for investigating the focusing properties of a cyclotron with a sectional magnet system. It was found that the envelope function has a maximum or minimum close to the boundary of magnetic field focusing or defocusing. (R.V.J.)

24877 THE LARGE HOMOPOLAR GENERATOR AT CANBERRA. J. W. Blamey, P. O. Carden, L. U. Hibbard, E. K. Inall, R. A. Marshall, and Mark Oliphant (Australian National Univ., Canberra). Nature, 195: 113-14(July 14, 1962).

Initial tests on the large homopolar generator at Canberra, which were designed to test the ability of the jets and machine to withstand the effects produced by drawing full current, are described. It was intended to observe several pulses with peak current of about 10^6 amp before

proceeding to the current of 1.6×10^6 amp for which the generator was designed. However, on the second such pulse, the unbalanced electromagnetic forces between the plate assemblies of the electrolytic load, due to uneven separations or current distribution, pushed these into contact, so that the current rose sharply to a peak of 1.8×10^6 amp. The jets, running at less than full flow, appeared to have carried this current satisfactorily, and measured deflections of the magnet and the jet structure were within the tolerances allowed. The current reacts on the magnet with a torque of 2000 ft-tons. These results were felt to be very encouraging. (P.C.H.)

24878 METHOD FOR SELECTING A SPIRAL FOR A CYCLOTRON WITH SPATIAL MAGNETIC VARIATION. Show-hsien Fang. Sci. Sinica(Peking), 11: 591-604(May 1962). (In Russian)

A cyclotron with field spatial variation $f = \epsilon \sin[\phi(r) - N\varphi]$ was studied, and a method for selecting a suitable variation curve $\phi(r)$ is discussed. In the central region the selected curve is Thomas-shaped and in the large radius section the curves are shaped as smoothly connected Archimedes spirals of various parameters. Reducing of the defocusing force to a minimum in a central region weakens the non-linear resonance. With this shift the potential of the dees is also weakened producing a maximum clearance between the magnetic spiral shims in the large radius area. (R.V.J.)

Plasma Physics and Thermonuclear Processes

24879 (AEDC-TDR-62-88) SOME GAS DYNAMIC CHARACTERISTICS OF ARGON PLASMA — APPLICATION TO JET SPREADING. K. E. Tempelmeyer and J. B. Dicks (Arnold Engineering Development Center, Tullahoma, Tenn.). July 1962. Contract AF40(600)-1000. 37p.

Jet spreading characteristics of a low-temperature argon plasma expanding from a sonic nozzle into still air at pressure ratios up to 18 are described. The argon plasma exhibited about the same jet spreading behavior and jet structure as cold argon when the two jets were compared at the same nozzle operating pressure ratios. Approximate calculations indicate that electromagnetic forces on the plasma were insignificant for these tests. Gas dynamic and heating analyses of plasma flows are suggested as a means of estimating effective thermal properties of the plasma and studying the over-all energy exchange process. (auth)

24880 (AFCRL-896(Pt.II)) THE FOUR MODES OF PROPAGATION OF ADIABATIC WAVES IN A PLASMA. RESEARCH ON A THEORY OF MAGNETOGAS DYNAMICS. Technical Note No. 1. J.-L. Delcroix, J.-M. Pihan, D. Quemada (Paris. Université, Orsay. Ecole Normale Supérieure. Faculté des Sciences) and J.-F. Denisse (Paris. Observatoire, Meudon). Dec. 5, 1960. Contract AF61(052)-432. 31p. (AD-269659)

A study of wave propagation in an infinite uniform plasma is presented. In most experimental applications, the plasma is limited. The many problems that this situation introduces are not discussed. Only the structure of different waves in the simplest case of plane wave in an infinite medium is examined. (auth)

24881 (AFCRL-1119) STUDY OF THE INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND PLASMAS. Final Report, August 1960–August 1961. Karl-Birger Persson (General Electric Co. Research Lab., Schenectady, N. Y.). Oct. 31, 1961. Contract AF19(604)-7433. 86p. (AD-270550)

The properties of the electron-ion plasma are determined by the random and collective behavior of the electrons, ions, and neutral particles. The collective as well as the random behavior of the electrons are in most cases responsible for the character of the interaction between the plasma and an applied electromagnetic field. The measurements on the transient plasmas lead to information about ways electrons are lost such as ambipolar diffusion, recombination, and attachment. Measurements of this kind were made on transient plasma for a long time with the microwave cavity method. Some measurements and conclusions are controversial because the interpreted effects are marginal. The effects are marginal because the measurements are done at too low electron densities. The objective is to extend the measurement that can be done through the interaction with an electromagnetic field into the high electron density range and resolve some controversial questions of the microwave cavity method. (auth)

24882 (ARL-250) RESEARCH ON THE MICROSTRUCTURE OF THE MAGNETIC FIELD IN A PLASMA. PART I. ON THE STATISTICAL DISTRIBUTION OF STOCHASTIC FIELDS. Final Technical Report. P. Teitelbaum and G. Kalman (Israel Inst. of Tech., Haifa). Dec. 15, 1961. Contract AF 61(052)-177. 39p.

Questions connected with the statistics of field quantities are considered. The model is a system of uncorrelated random sources, the field quantities being linear and instantaneous functions of the source coordinates. General properties of the C function, non-uniform particle density, the evaluation of the C function for binary field correlations are studied. Polynomial expansion in terms of the Fourier-component of the non-uniformity and the distance and inverse distance between the correlation points are given. (auth)

24883 (ARL-251) COLLECTIVE MODES IN A PLASMA DUE TO TRANSVERSE INTERACTION. Final Technical Report. G. Kalman (Israel Inst. of Tech., Haifa). Dec. 31, 1961. Contract AF 61(052)-393. 135p.

The collective motion of a plasma due to the static magnetic interaction between the particles was studied with the aid of the random phase approximation. A close analogy with plasma oscillations is demonstrated. An equation of motion for j_k (Fourier-component of the current-density) was established. The motion may assume oscillatory or unstable character, depending on the anisotropy of the velocity distribution. No collective motion is excited in thermal equilibrium. Then the effect of a more sophisticated model where both external magnetic field and the coupling of the two component species are taken into account, was considered. The stabilizing effect of the magnetic field, and new modes, such as magnetohydrodynamic waves, cyclotron waves, and a peculiar two-component instability, were derived. A general dispersion-relation was also considered. The motion was decomposed into individual and collective contributions and the self-consistency requirement established the dispersion-relation. For large wave numbers the oscillatory motion suffered a Landau-damping, while in the case of increasing modes there is a maximum wave number that limits the spectrum of instabilities. A beams treatment supplements the analysis. (auth)

24884 (ASD-TDR-62-259) $\mathbf{J} \times \mathbf{B}$ MAGNETOHYDRODYNAMIC (MHD) WORKING FLUIDS. Meredith C. Gourdine (Plasmadyne Corp., Santa Ana, Calif.). Apr. 1962. Contract AF33(616)-8173. 77p.

A literature survey covering the three types of MHD pro-

pulsors (shunt, series, induction) is provided. A theory suitable for analyzing the performance of the steady $\bar{J} \times \bar{B}$ accelerator was developed. The performance of various working fluids was determined using the criterion of maximum propulsion efficiency. Two broad classes of working fluids were considered: equilibrium plasmas and non-equilibrium plasmas. Non-equilibrium plasmas have the advantage of good performance without high-temperature materials problems. A conductivity of 170 mhos/m in argon was experimentally produced and measured in a "ring" discharge at a pressure of 1 mm of Hg with a power input of approximately 1 kw. A temperature of over 5,000°K is required to do this thermally. (auth)

24885 (ASD-TR-61-283) THE ARC JET AS A MEANS OF PRODUCING FULL TEMPERATURE SIMULATION IN A HYPERSONIC WIND TUNNEL (APPLICATION OF A CROSSED FIELD ACCELERATOR). R. M. Krupka and P. J. Dickerman (Chicago. Univ. Labs. for Applied Sciences). July 1961. Contract AF33(616)-6147. 108p. (AD-269206; LAS-TR-162-25)

The general concept of using crossed electrostatic and magnetic fields to accelerate the flow of an ionized plasma was investigated experimentally and theoretically. The experimental installation consists of an air-stabilized arc which serves as the plasma generator, an inlet viewing chamber for velocity measurements, the acceleration section, an outlet viewing chamber, the test section with quartz viewing window, and the vacuum system. The experimental effort consists in correlating the input and output accelerator velocity and Mach number with the applied electromagnetic fields, mass flow, and gross operating parameters of the installation. The theoretical results of the one-dimensional, steady, compressible flow treatment of the problem are presented. These results are summarized in the form of nondimensional charts which display the role of the relevant nondimensional groups that enter into the interaction. These charts readily establish the performance limits of such an accelerator. (auth)

24886 (CLM-R-19) NUMERICAL CALCULATIONS ON REVERSED FIELD HEATING IN THE THETATRON. G. B. F. Niblett and D. L. Fisher (United Kingdom Atomic Energy Authority. Research Group. Culham Lab., Culham, Abingdon, Berks, England). Mar. 1962. 27p.

Numerical solutions of the two-fluid hydromagnetic equations designed to study the effect of trapped magnetic fields on the properties of a plasma compressed in the theta are discussed. Conditions typical of the AWRE Maggi condenser banks were selected: deuterium at an initial pressure of 100μ contained in a tube 4 cm in diameter is compressed by a field rising to 100 kilogauss in 2.5 μ sec. Initial bias fields of between +5 and −5 kilogauss were used, and the effects of preheat and rate of compression were assessed. The calculations showed that rapid joule heating is maintained by the large field gradients characteristic of reversed field discharges, and for an initial bias field of −5 kg a peak electron temperature of 1.3 kev was predicted. (auth)

24887 (D1-82-0170) SOME EXACT SOLUTIONS FOR TWO-DIMENSIONAL HYDROMAGNETIC STEADY FLOWS. L. C. Levitt (Boeing Scientific Research Labs., Seattle). 1 June 1962. 31p.

A study is presented of two symmetry-types of planar hydromagnetic steady flows of a uniform, incompressible conducting fluid, moving under the influence of its own magnetic field. The motions considered are special cases of a fairly wide class of hydromagnetic flows exhibited by Lin. The equations of motion and induction, for both types, are formulated as nonlinear partial differential equations in a pair of stream functions, for the fluid velocity and magnetic field. Various general features of these flows are discussed, and a number of special exact solutions are derived for one of these types, in unbounded space. A method is given by which the formulation of the infinite-conductivity cases is reducible to a single equation. (auth)

24888 (NBS-7244) ON THE CRYOGENIC ASPECTS OF PROJECT SHERWOOD. Ninth Progress Report, January 1, 1962–March 31, 1962. (National Bureau of Standards, Boulder, Colo.). 28p.

Measurements on the conductivity of Nb wire are reported at 4.0°K. It was found that the qualitative behavior in low fields is that of an ideal bulk superconductor. The behavior in high fields suggests that the material breaks up into a filamentary superconducting structure. Intermediate state measurements require magnetic fields well over 100 kgauss. Comparison of the intermediate state behavior for Nb, Nb-Zr, and Nb_3Sn indicates that Nb and Nb-Zr behave similarly. Research results are also reported on magnet materials, and development of a refrigeration system incorporating a single expansion machine. (J.R.D.)

24889 (NP-11601) INVESTIGATION OF CONDENSATION PROCESSES BEHIND NORMAL SHOCKS BY OPTICAL METHODS—A FEASIBILITY ANALYSIS. Preliminary Report. Y. Timnat and S. H. Bauer (Cornell Univ., Ithaca, N. Y.). Mar. 1962. Contract AF 49(638)-716. 20p. (CU-7356)

The conditions under which solid particles, formed in a shock tube by thermal decomposition of selected compounds, may be detected were analyzed. Experimental methods for determining the induction time for the initial condensation, the number of particles formed per unit volume, and their rate of growth are proposed. Optical methods of detection seemed most promising. The principles of light scattering by small particles and their application to condensation problems in a shock tube are discussed. An analysis of the second parameter to be measured is presented. Specific proposals for experiments are described. (M.C.G.)

24890 (ORNL-3258) BLANKETS FOR THERMONUCLEAR REACTORS. C. J. Barton and R. A. Strehlow (Oak Ridge National Lab., Tenn.). July 12, 1962. Contract W-7405-eng-26. 23p.

A study of blanket requirements for thermonuclear power reactors is presented and complemented with a short critical review of some blanket systems which have been suggested. An indication is made of some research problems associated with the blanket system presently considered most promising. (auth)

24891 (RADC-TN-61-222) ENERGY TRANSFER IN PLASMAS. Mid-term Report, February 2, 1961 to August 25, 1961. (General Telephone and Electronics Labs. Inc., Palo Alto, Calif.). Sept. 21, 1961. Contract AF30(602)-2452. 43p. (AD-267097)

The effect of metastable atoms on the absorption of microwave energy is being studied. This process is not only important in the simple gases such as helium but even more so in the more complicated gases such as oxygen and nitrogen. Thus the program is designed to perfect diagnostic tools by a study of metastable production in a helium discharge. A program of shock tube improvement was initiated to provide a shock wave from which extraneous effects are removed. In this way more definitive correlation between theory and experiment may be attained. (auth)

24892 THE RELATION BETWEEN THE TRANSPORT AND THE ORBIT MODELS FOR A PLASMA. S. Frankenthal and W. P. Allis (Massachusetts Inst. of Technology, Cambridge). IRE (Inst. Radio Engr.) Trans. Antennas Propagation, AP-10: 15-23(Jan. 1962).

Starting with the Boltzmann equation and the dynamic equation of a charged particle, a transport (particle) model for the plasma, as well as an orbit (guiding-center) model which is valid for arbitrarily large orbits were developed. The development facilitates the interpretation of the difference between the two models, and sets the stage for the derivation of the conditions under which the two become interchangeable. These conditions include restrictions on the particle distribution and on the field gradients. The role of each model in the formulation of the self-consistent-field problem in the plasma is discussed. (auth)

24893 PROPAGATION IN A WAVEGUIDE FILLED NON-UNIFORMLY WITH PLASMA. G. H. Bryant (Royal Military Coll. of Science, Shrivenham, Eng.). J. Electronics and Control (1), 12: 297-305(Apr. 1962). (In English)

By dividing the plasma radially into an inner attenuating region of high average electron density and an outer region of lower average electron density, an approximate solution is obtained for the E_{01} mode in a plasma-filled cylindrical waveguide. The dependence of cut-off frequency on the plasma frequency (ω_{po}) at the guide center and on the guide radius (b) is determined, and an estimate made of the maximum value of ω_{po} b allowed before distortion of the normal waveguide mode occurs. When ω_{po} b > 11 × 10^{10} cm/sec, the E_{01} mode maximum no longer appears at the center of the guide but at a radius that decreases with frequency. (auth)

24894 SOME EXACT SOLUTIONS OF MAGNETO-HYDRODYNAMIC VISCOUS FLOW PROBLEMS. H. P. Greenspan and L. A. Peletier (Massachusetts Inst. of Tech., Cambridge). J. Math. and Phys., 41: 116-31(June 1962).

A semi-infinite plate moving parallel to its leading edge, in a magnetic field that is perpendicular to the leading edge and oblique to the plane of the plate, and in an infinite viscous electrically conducting medium, is studied. Steady-state motion of a perfectly electrically conducting plate and oscillatory motion of a nonconducting plate are considered. The propagation of Alfven waves into the medium is analyzed. The dependence of the current distributions, specific drag, etc. on the basic flow parameters is discussed. An exact oscillating plate solution is presented. A modified method of steepest descents is used to determine the asymptotic nature of the solution. (T.F.H.)

24895 PROJECT FOR THE PRODUCTION OF CONTROLLED NUCLEAR FUSION. K. Nowak. Neue Physik, 2: 154-7(1960-1961). (In German)

By opposition of two magnetically pinched hydrogen ion beams under 100 kev acceleration and with electron injection, it is possible to produce a dissociated plasma with an approximate temperature of 1.5 million degrees K. The fusion assumed can be explained by the temperature value and also by the Coulomb effects. (auth)

24896 A PROJECT FOR CONTROLLED NUCLEAR FUSION. K. Nowak. Neue Physik, No. 4, 154-164(1960-1961). (In German)

By a direction in opposition to two magnetically contracted hydrogen atom ionic streams with an acceleration of 100 kv each and with later additions of electrons, it is possible to produce a dissociated plasma with an approximate temperature of 1.5 billion degrees K. The fusion assumed can be explained by the temperature value and also through Coulomb's effects. (auth)

24897 THE CERENKOV EFFECT AND THE ANOMALOUS DOPPLER EFFECT IN PLASMA WITH MAGNETIC FIELD. E. Canobbio (Institut für Plasmaphysik G.m.b.H, Garching, Ger.). Nuovo cimento (10), 23: 1073-9(Mar. 16, 1962). (In Italian)

The energy loss of a charged particle moving uniformly in a plasma, along an external magnetic field B_0, is calculated. As an example of the anomalous Doppler effect, the instability of waves excited in a cold plasma by an infinitely extended electron beam parallel to B_0 is also described. (auth)

24898 RELATION BETWEEN BREMSSTRAHLUNG AND FRICTION IN A PLASMA. I. Fidone (EURATOM-CEA, Fontenay-aux-Roses, France). Nuovo cimento (10), 24: 823-34(June 1, 1962). (In English)

The low frequency bremsstrahlung in plasma is calculated, taking into account the spatial correlation of interacting particles. (auth)

24899 ON ONE NON-LINEAR PROBLEM OF AN ELECTROMAGNETIC WAVE THEORY IN PLASMA. Yu. N. Dnestrovskii and D. P. Kostomarov (Moscow State Univ). Radiotekh. i Elektron., 6: 1667-9(1961). (In Russian)

The nonlinear theory and linear kinetic equations coincide in the case of electromagnetic wave propagation in plasma transverse to an external magnetic field H_0 and polarized along the field (an ordinary wave). (R.V.J.)

24900 ELECTROSTATIC STABILITY OF A NON-MAXWELLIAN HOMOGENEOUS PLASMA. D. Pfirsch (Max-Planck-Institut für Physik and Astrophysik, Munich). Z. Naturforsch., 17a: 315-20(Apr. 1962). (In German)

For studying the electrostatic stability or instability of a homogeneous plasma with a non-Maxwellian velocity distribution of the electrons and ions, both undisturbed distribution functions were expanded into a series of Hermitian polynomials multiplied by a Gaussian function. By this procedure the dispersion-relation derived from the linearized Vlasov equation was expressed by the coefficients of that expansion and by the temperature and the mean velocity of the electrons and ions. This dispersion-relation is discussed numerically for certain sets of these parameters which in particular include the effect of run-away electrons. They cause an instability just at the moment when they lead to a second maximum in the undisturbed distribution function. This second maximum does not have to be very large to get rather high growth rates (~0.05 ω_p in the examples given) for the unstable modes, the real part of the frequency being of the order ω_p and the wave length of the Debye length. The critical mean velocity for the onset of two-stream instability of the electrons against the ions tend to increase (rather than diminish) by the run-away electrons. (auth)

24901 THE TRANSFORMATION OF THE KINETIC ENERGY OF A STATIONARY PLASMA CURRENT INTO ELECTRICAL ENERGY UPON ITS ISOTHERMAL DAMPING IN A TRANSVERSE MAGNETIC FIELD. V. M. Satychev. Zhur. Priklad. Mekh. i Tekh. Fiz., No. 2, 3-6 (Mar.-Apr. 1962). (In Russian)

Fundamental equations of a magnetohydrodynamic generator, in which electrical energy is obtained by isothermal damping of the plasma in a transverse magnetic field, are presented. Optimum conditions for the damping are derived, as is the angle by which the plasma is spread out during the process. Plasma damping in a linear magnetic field is described when there exist wall electrodes at different potentials along the plasma canal. (TTT)

24982 THE GENERATION OF AN ELECTRIC CURRENT DURING THE FLOW OF PLASMA THROUGH A PIPE. E. I. Andrienkin. Zhur. Priklad. Mekh. i Tekh. Fiz., No. 2, 7-13(Mar.-Apr. 1962). (In Russian)

Calculations are performed to determine the coefficient of electrical efficiency of a plasma generator. The case considered is a pipe of rectangular cross section, and the plasma consists of a mixture of nitrogen with 1% potassium vapor. The calculation neglects the following factors: anisotropy of conductivity, end losses, heat losses at the walls, and electrical resistance losses in the layer near the electrodes. This means that the actual efficiency of the generator is lower than the values calculated. The results are presented in graphical form. For a typical case the maximum electrical efficiency is about 19%, while for a current with constant conductivity and neglecting friction the efficiency is about 17%. (TTI)

Shielding

Refer also to abstract 24223.

24983 (ASD-TDR-62-244) ELECTROSTATIC SHIELDING OF HIGH ENERGY PROTONS. Thomas W. Bailey (Aeronautical Systems Div., Wright-Patterson AFB, Ohio). Mar. 1962. 21p.

Electrostatic shielding was studied to determine if it should be considered for protecting manned space vehicles against solar cosmic rays. It was concluded that electrostatic shielding is feasible and that it has some advantages over other types of shields. However, considerable applied research will be necessary. (auth)

24984 (DC-61-2-98) OTT IV AND V ACTIVATION TAPE DATA (AT-122). E. White (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). June 20, 1962. Contract AT(11-1)-171. 192p.

Neutron activation data are presented from tape measurements made inside configurations during test sequences IV (10-29-58 to 11-19-58 and 1-6-59 to 1-15-59) and V (5-1-59 to 6-15-59) in the Outside Test Tank. The data are presented graphically as tape activity at reactor shutdown time (counts/min-gm-watt) as a function of distance across the coffin at various distances from the radiation source. Diagrams of the configurations tested precede the activation data. The configurations were variations of porous plugs. (auth)

24985 (NAA-SR-Memo-7347) MACE--A MONTE CARLO EVALUATION OF FAST NEUTRON COLLIMATORS. R. E. Kaiser, W. J. Roberts, K. L. Rooney (Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 27, 1962. Contract [AT(11-1)-Gen-8]. 34p.

MACE is a Monte Carlo code, written for the IBM 7090, to evaluate the efficiency of radiation collimators in terms of the ratio of collided to uncollided flux reaching a target. The analysis can be performed with as many as 30 energy groups. Up to 5 materials (8 elements) may be used in the description of the collimator system. Provisions are included for specification of source particle density and angular distribution functions and for tilt of the source plane with respect to the axis of the collimator. (auth)

24986 (USNRDL-TR-558) THE ANGULAR DISTRIBUTION OF DOSE RATE FROM GAMMA RAYS SCATTERED THROUGH VARIOUS THICKNESSES OF IRON AND ALUMINUM. T. S. Dahlstrom and W. E. Thompson (Naval Radiological Defense Lab., San Francisco). Apr. 19, 1962. 74p.

The angular distribution of dose rate resulting from gamma rays of Co^{60} and Cs^{137} transmitted through various thicknesses of iron (0.737 and 1.6 in.) and aluminum (2, 4, and 9 in.) was measured. The experimental results are compared with Monte Carlo calculations. Comparisons over a limited range of the angular variables are also made with dose-rate distributions calculated from gamma-ray spectrometric data. (auth)

24987 (WAPD-T-1464) PENETRATION OF POINT MONODIRECTIONAL GAMMA RAYS THROUGH SLAB SHIELDS. K. Shure (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). June 1962. Contract AT(11-1)-Gen-14. 15p.

A Monte Carlo program, GR-1, was written for estimating the spatial distribution of gamma radiation from a monoenergetic point monodirectional source which penetrates the last face of several slab shields. Comparison of results obtained with this program with results from experiment and other calculation verified the validity of the program. (auth)

24988 ATTENUATION OF HIGH-ENERGY NEUTRONS IN CONCRETE. L. N. Zaĭtsev, M. M. Komochkov, and B. S. Sychev. Atomnaya Energ., 12: 525-7(June 1962).

In view of the use of heavy concretes for shielding high-energy accelerators, the attenuation of high-energy neutrons in concretes of various composition must be closely studied. Such investigations were carried out with the synchrocyclotron of the Joint Institute for Nuclear Studies, continuing previous work (M. M. Komochkov Atomnaya Energiya, 11: 399(1961) No. 10). Blocks made of concretes with densities of 2.35, 3.2, and 4.1 g/cm^3 were used for the tests. The lightest specimen corresponded to the material used for shielding the synchrocyclotron; its half-value thickness is already known. The Fe content of the specimens increased with the density from 0.4 to 41.0 and 75.0 wt. %. The high-energy flux was determined by the $C^{12}(n,2n)C^{11}$ reaction which has a threshold of 20 Mev. The attenuation of the high energy, E > 20-Mev neutrons was found to follow the exponential law in all the three specimens when the thickness of the layers exceeded 20 to 40 cm. This thus refutes the widespread opinion that in this range the half-value thickness is inversely proportional with the density of the concrete. This erroneous notion was often responsible for the use of high-density concrete, resulting in an increased cost for the shield. Use of such concrete may be justified only in a few special cases. (TTI)

24989 ADSORPTION DOSE FACTOR OF A CYLINDRICAL SOURCE IN THE PRESENCE OF A SHIELD. D. P. Osanov and E. E. Kovalev. Atomnaya Energ., 12: 528(June 1962). (In Russian)

Results obtained in experiments involving a cylindrical source with activity adsorbed on its surface (Atomnaya Energiya, 10: 515(1961) No. 5) were further generalized, considering a case in which the cylindrical source is placed behind a $\rho_1 d$-thick shield. The values computed from $f(\rho_1 d)$ for various parametric values of the source and the shield were tabulated. The adsorption dose factor was calculated under the assumption that no multiple scattering takes place within the shield. The effect of scattering may be evaluated from the value of the equivalent absorption length, introducing the buildup factor into the equation. The ratio of the buildup factors of the hollow and solid cylindrical sources differs only slightly from unity from which it can be shown that the equation derived defines the adsorp-

tion dose factor of a cylindrical source in the presence of a shield with a precision of at least 10 to 15%. (TTT)

24910 BIOLOGICAL SHIELDING FOR RADIATION BELT PARTICLES. D. L. Dye (Boeing Airplane Co., Seattle) and J. C. Noyes. J. Astronaut. Sci., 7: 64-70(1960).

Calculations are made, for the particle spectra in the most intense regions of the radiation belts, of the attenuation of the particle flux by shielding on a space vehicle, and of the biological dose rate due to the flux which has penetrated the shielding. Both protons and electrons are considered in the inner belt, but only electrons in the outer belt. Secondary particles and bremsstrahlung produced by these particles on interacting with a shield are also considered. It is shown that, despite the much higher electron fluxes, the protons are of much greater biological significance. (Meteorol. Geoastrophys. Abstr., 13: No. 1, Jan. 1962).

24911 SCATTERING OF Co^{60} GAMMA RAYS OFF CONCRETE. A. F. Holloway and E. M. Campbell (Manitoba Cancer Treatment and Research Foundation, Winnipeg, Can.). Radiology, 79: 126-31(July 1962).

Data are presented from which it is concluded that the exposure dose rate at a point in a field of irradiation will be increased by radiation scattered from neighboring structures irradiated by the beam. This increase has been shown to be from approximately 2 to 14% under the conditions of irradiation in this study. This addition to the primary exposure dose rate should be considered in the design of whole-body irradiators in order that homogeneous dose distribution may be obtained. However, on consideration of the data given, it would appear that irregularities in the vertical field due to the contribution of scattered radiation could be overcome by the use of relatively thin filters which would reduce the dose at floor level by approximately 10%. The data were also found of use in determining protective barrier thicknesses in Co^{60} treatment room walls, particularly in the entrance maze, where walls, although not themselves subject to primary irradiation, may be exposed to appreciable quantities of scattered radiation when the primary beam is incident on adjacent structures. (auth)

Theoretical Physics

24912 (AD-270903) UNITARITY, CROSSING SYMMETRY AND COMPLEX POLES IN LOW ENERGY SCATTERING THEORY. B. H. Bransden (Glasgow Univ.) and J. W. Moffat (RIAS. Div. of Martin Co., Baltimore). Jan. 22, 1962. 16p.

The problem of asymptotic limits and the consistency of the low-energy solutions of pion-pion scattering are clarified with an analysis of unitarity, crossing symmetry, and complex poles in low energy scattering theory. (N.W.R.)

24913 (JINR-P-890) OB OGNOM NELINEINOM SINGULYARNOM INTEGRAL'NOM URAVNENII TIPA URAVNENII RASSEYANIYA LOU. (A Nonlinear Singular Integral Equation of the Type of Low Scattering Equation). R. Denchev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 13p.

A nonlinear singular integral equation of type of the Low scattering equation and the corresponding nonlinear boundary problem in the theory of analytical functions are considered. The problem is formulated somewhat more generally. It turns out that there exists a new class of solutions. An explicit form of all the solutions is found. In particular, an equation of this type which has no solution is given as an example. (auth)

24914 (JINR-P-901) O NEKOTORYKH OPERATORAKH SVYAZANNYKH S ODNIM URAVNENIEM TIPA URAVNENII RASSEYANIYA LOU. (Certain Operators Connected with an Equation of the Type of Low Scattering Equation). R. Denchev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1962. 10p.

The solution of the nonlinear singular integral equation is investigated, as well as some related operators. The reasons for the solution not to be unique are explained. (auth)

24915 (NP-11612(Vol.II)) RELATIVISTIC QUANTUM MECHANICS AND QUANTUM FIELD THEORY. VOLUME II. LECTURES BY J. SUCHER. Technical Report No. 249. R. Fong (Maryland. Univ., College Park). Mar. 1962. Contract AF 49(638)-24. 97p. (Handwritten M. S. copy).

Notes on lectures on interacting fields in quantum electrodynamics are presented. Topics covered include: interacting Dirac and Maxwell fields; structure of H_1, fundamental virtual processes in quantum electrodynamics; classification of processes; time-ordered diagrams; rules for the construction of the contribution to T_{ba} from a time-ordered diagram, and rules for the construction of the contribution to S_{ba} from a Feynman diagram. Propagation functions for scalar and spinor fields, the theorems of Wick, and Feynman diagrams are discussed as proof of the Feynman rules. (M.C.G.)

24916 (NP-11738) SYMMETRY PROPERTIES OF THE S-MATRIX WITH APPLICATION TO RESONANCE REACTIONS (thesis). Technical Report No. 9. K. T. R. Davies and M. Baranger (Carnegie Inst. of Tech., Pittsburgh). [1962]. Contract Nonr 760(15). 78p.

Symmetry relations of the s-wave, N-channel S-matrix are rederived and applied to a study of its structure in the vicinity of resonances, both away from and near thresholds. A resonance is defined as a pole of the S-matrix. For an isolated pole far from any threshold, the S-matrix can be expressed as the sum of a resonance factorable matrix and a nondiagonal, background matrix. The parametrization of this expression is discussed. Two types of threshold resonances are considered, corresponding to one and two poles of S respectively. For both cases, the S-matrix again has resonance and background contributions, but the off-diagonal elements involving the opening channel have no background. The two-pole threshold resonance obeys the standard Breit-Wigner formula, while the one-pole case has a different behavior, which can only be obtained from the Breit-Wigner expression by making certain reduced widths infinite. Unitarity and symmetry relations impose some interesting restrictions on the distribution of poles and the shape of cross sections near threshold. The results are illustrated with various two-channel examples. (auth)

24917 (UCRL-Trans-796(L)) THE WAVE EQUATION FOR A NON-UNIFORM MEDIUM. S. L. Sobolev. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Berkeley) from Trudy Seismol. Inst. Akad. Nauk S.S.S.R., No. 6, 1-57(1930). 63p. (Includes original, 30p.)

An integration method for solving the wave equation for assigned initial conditions was developed. The problem is that of expansion of the Kirchhoff method to a non-uniform medium. Proof is presented for the existence of a solution for the wave equation satisfying the initial conditions. (M.C.G.)

24918 QUANTUM ELECTRODYNAMICS WITHOUT POTENTIALS. Stanley Mandelstam (Univ. of Birmingham, Eng.). Ann. Phys. (N. Y.), 19: 1-24(July 1962).

A scheme is proposed for quantizing electrodynamics in

terms of the electromagnetic fields without the introduction of potentials. The equations are relativistically covariant and do not require the introduction of unphysical states and an indefinite metric. Calculations carried out according to quantization methods in the Coulomb or Lorentz gages are justified in this formalism. The theory exhibits an analogy between phases of operators and electromagnetic fields on the one hand, and coordinate systems and space curvature on the other. It is suggested that this analogy may be useful in quantizing the gravitational field. (auth)

24919 QUANTIZATION OF THE GRAVITATIONAL FIELD. Stanley Mandelstam (Univ. of Birmingham, Eng.). Ann. Phys. (N. Y.), 19: 25-66(July 1962).

A scheme proposed for the gage-independent quantization of the electromagnetic field is applied to the coordinate-independent quantization of the gravitational field. Einstein's theory is first reformulated so as to avoid reference to a coordinate system. The quantization of the resulting theory is then carried through. No mention is made of unphysical variables such as the metric tensor except for the purpose of linking this formalism with conventional theories; the gravitational field is described by the Riemann tensor and its connection with space curvature is made clear. First-order perturbation calculations are carried out and give results equivalent to those of "flat-space" theories. (auth)

24920 QUANTUM GEOMETRY. Nathan Rosen (Israel Inst. of Technology, Haifa). Ann. Phys. (N. Y.), 19: 165-72 (July 1962).

A formalism is developed that may provide a framework for a singularity-free description of elementary particles. It is suggested that points of space have associated with them not only coordinates, but also momenta. Complex combinations of these, of the form $\xi_k = x_k + i\alpha p_k$ and $\xi_k^* = x_k - i\alpha p_k$, are taken as the fundamental variables, and the state of a point is described by means of them. Fields that have a certain simple type of dependence on these variables behave like nonlocalized fields as functions of the coordinates. In the four-dimensional case it is found necessary to deal only with spacelike hypersurfaces. (auth)

24921 ON THE MICROSCOPIC DETERMINATION OF TRANSPORT COEFFICIENTS. Robert James Swenson (Lehigh Univ., Bethlehem, Penna.). Dissertation Abstr., 22: 3705(Apr. 1962).

The formal expressions for transport coefficients which are obtained in the ensemble theory of irreversible processes are investigated and a method for reducing them to more practical forms is proposed. To this end, a many-body theory is developed which makes use of a perturbation expansion in terms of a scattering matrix or t-matrix, rather than the potential, and is thus immediately applicable to situations in which the interaction potential contains a hard core. A transport coefficient is related to a time integral of a microscopic correlation function whose time dependence is described by the non-Markovian generalized master equation of van Hove. A simplified derivation of this equation is given and the quantities which appear in it are expressed in terms of the t-matrix. In general the evaluation of a transport coefficient requires that non-Markovian effects be taken into consideration. It is shown that transport coefficients for a system in a quasi-steady state can be determined from the generalized Pauli equation (which is a Markovian equation) which is derived from the generalized master equation. The density dependence of the various quantities which appear are analyzed and the Pauli equation and the expression for the transport coefficient are obtained in the limit of low density. It is demonstrated that in this limit the N-body dependence of the equations can be reduced to a one-body dependence, and in fact, the results are identical to those obtained using the Boltzmann transport equation. These results are obtained without performing coarse-graining or time-smoothing operations or assuming molecular chaos, whereas these are required in the usual derivations of the Boltzmann equation. As an example, the formalism is applied to the thermal conductivity of a dilute non-degenerate quantum gas, and the result obtained agrees with the Boltzmann equation result.

24922 A COMPUTER METHOD FOR CALCULATING DIRAC TRACES WITH APPLICATIONS TO QUANTUM ELECTRODYNAMICS. Ralph Myron Wilcox (Univ. of Colorado, Boulder). Dissertation Abstr., 22: 3705(Apr. 1962).

The method of Dirac traces has been widely used for calculating transition probabilities for cross sections and lifetimes of processes involving Dirac particles. Heretofore one had to calculate the traces by hand, using a tediously repetitive algebraic procedure. Although the calculations were long, often a comparatively simple result would be obtained. A computer program capable of calculating and multiplying all such traces is described. With this method, only a relatively small amount of data required to specify the problem has to be given. The computer performs the algebra and gives the results in algebraic form in terms of any suitably chosen set of scalar products. A detailed description is given of how the program may be employed to solve specific problems. Details are also given explaining how the program works. However, it is not necessary to know how the program works to know how to use it. The method is applied to the problem of Compton scattering of unpolarized radiation by a polarized target electron, the polarizations of the recoiling particles not being observed. An asymmetrical contribution to the cross section is found to result. Curves of the asymmetry are plotted for various angles and energies. The expression for the asymmetry is found to reduce to a very simple form in the non-relativistic limit.

24923 GAUGE INVARIANCE AND SPECTRAL REPRESENTATIONS IN QUANTUM ELECTRODYNAMICS. Donn Gene Shankland (Ohio State Univ., Columbus). Dissertation Abstr., 22: 3705(Apr. 1962).

It is shown that in quantum electrodynamics, with a Lagrangian which yields the Maxwell and Dirac equations, it is impossible to have a unitary transformation between interacting operators at different times; to have observables, such as current, invariant under gauge transformations; and to have only positive energy states taking part in physical processes. The explicit change in the observed current due to a gauge change is calculated by using the Schwinger formalism. The vanishing of this change is shown to imply that the spectral function for the electromagnetic field is a Dirac delta function, and hence that the electromagnetic field has no interactions, contradicting the original assumptions. Some possible consequences of this inconsistency are then discussed.

24924 A NOTE ON THE SPIN AFFINE CONNECTION. A. H. Klotz (Rutherford Coll. of Tech., Newcastle-upon-Tyne, Eng.). Nuovo cimento (10), 23: 1054-6(Mar. 16, 1962). (In English)

An elementary method of calculating 24 of the 32 component parts of the spin affine connection is presented. It is shown that this method is independent of the assumption of symmetry of the affine connection. (auth)

24925 THOMAS PRECESSION AND CLASSICAL THEORIES OF SPINNING PARTICLES. P. Nyborg (Univ. of Oslo, Blindern, Norway). Nuovo cimento (10), 23: 1057-60 (Mar. 16, 1962). (In English)

Various theories of spinning particles are connected through general principles. It is shown that the Thomas factor appears only in theories in which the spin is a constant of the motion for a free particle. (auth)

24926 γ_5-AMBIGUITY IN THE GENERALLY COVARIANT SPIN AFFINE CONNECTION. J. R. Klauder (Universitlit, Bern and Bell Telephone Labs., Murray Hill, N. J.), H. Leutwyler, and J. Schaer. Nuovo cimento (10), 23: 1099-1101(Mar. 16, 1962). (In English)

An equation by which the spin affine connection is defined through the vanishing invariant divergence of a product of two Dirac matrices, is shown to be a simple consequence of taking not the individual $\gamma_\mu(x)$ but rather the product field $\gamma_\mu\gamma_\nu$ as fundamental. (auth)

24927 QUANTUM ELECTRODYNAMICS WITH DIRAC MONOPOLES. N. Cabibbo (Universitä, Rome and C.N.E.N., Frascati, Italy) and E. Ferrari. Nuovo cimento (10), 23: 1147-54(Mar. 16, 1962). (In English)

A quantized theory for the interactions of the electromagnetic field with magnetic monopoles and electrically charged particles is developed, without making use of potentials. Monopoles and charged particles are treated in a symmetrical way; the internal consistency of the theory requires the fulfillment of the Dirac condition (that the magnetic charge of the monopoles be equal to $2\pi n/e$, where n is an integer). The symmetry properties of the theory are discussed. It is shown that although parity is not conserved, parity nonconservation effects can appear only if physical magnetic monopoles are present. (T.F.H.)

24928 ON THE INTERPRETATION OF A QUANTUM THEORY WITH INDEFINITE METRIC. Rolf Hueper (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch., 17a: 380-97(May 1962). (In German)

A special field theoretical model was constructed to study the problem of probability interpretation of a quantum theory with indefinite metric. The model is based on the Heisenberg dipole-ghost version of the Lee model, but with an additional V Θ-interaction. This interaction yields bound states in the sector N + 2 Θ. A situation similar to a case studied by Pauli and Källén was obtained. It seems that the arising difficulty can be solved only by means of a boundary condition suggested by Bogoliubov. However, such a condition excludes the possibility of interpreting bound states as "physically realizable" states. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 23377, 24027, 24353, 24354, 24355, 24356, 24357, 24358, 24380, 24381, 24384, 24385, 24387, 24392, 24397, 24398, 24399, 24400, 24401, 24402, 24403, 24404, 24405, 24406, 24407, 24408, 24409, 24410, 24411, 24412, 24413, 24414, 24415, 24418, 24420, 24421, 24422, 24424, 24425, 24426, 24427, 24428, 24429, 24430, 24435, 24436, 24437, 24438, 24439, 24440, 24441, 24442, 24449, 24452, 24454, 24457, 24462, 24477, 24483, 24485, 24489, 24490, 24495, 24496, 24498, 24499, 24501, 24503, 24504, 24509, 24511, 24512, 24513, 24514, 24515, 24516, 24517, 24518, 24521, 24522, 24523, 24524, 24525, 24526, 24527, 24528, 24529, 24530, 24531, 24532, 24533, 24534, 24535, 24536, 24537, 24538, 24540, 24541, 24542, 24543, 24544, 24546, 24551, 24586, and 24649.

24929 (AAEC/E-89) DESIGN OF CONCENTRIC TUBULAR REACTOR FUEL ELEMENTS FOR UNIFORM COOLANT CONDITIONS. Ian M. Binns and R. Licciardo (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). June 1962. 19p.

Concentric tubular reactor fuel element geometries to give equal coolant outlet temperatures are presented. Oscillations from tube to tube in thickness and temperatures generally occur but it is possible to eliminate them by property selecting the center element. This element may be a fuel rod or a nonheat-producing rod with or without a surrounding annulus of fuel. The geometries and temperatures are dependent on the voidage and on nondimensional parameter equivalent to a Biot number based on the channel equivalent diameter. (auth)

24930 (AE-75) TWO-GROUP CURRENT-EQUIVALENT PARAMETERS FOR CONTROL ROD CELLS. AUTOCODE PROGRAMME CRCC. O. Norinder and K. Nyman (Aktiebolaget Atomenergi, Stockholm). June 1962. 18p.

In two-group neutron diffusion calculations the influence of control rods is described by equivalent homogeneous two-group parameters in regions about the control rods. The property of fast and thermal neutron current equivalence is selected to obtain equivalent two-group parameters for a homogeneous cell with the same radius as the control rod cell. For the parameters determined one obtains the same fast and thermal neutron current into the rod cell and the equivalent cell independent of the fast and thermal flux amplitudes on the cell boundaries. The equivalent parameters are obtained as a solution of a system of transcendental equations. A Ferranti Mercury Autocode performing the solution is described. Calculated equivalent parameters for control rods in a heavy water lattice are given for some representative cases. (auth)

24931 (ANL-6561) BOILING WATER REACTOR TECHNOLOGY STATUS OF THE ART REPORT. VOLUME I. HEAT TRANSFER AND HYDRAULICS. P. A. Lottes (Argonne National Lab., Ill.). Feb. 1962. Contract W-31-109-eng-38. 189p.

Information on heat transfer and hydraulics pertinent to the design and operation of boiling water reactor power plants is presented. The following areas of discussion are covered: heat transfer, two-phase density studies, two-phase pressure drop, critical heat flux and burnout, boiling stability, calculation procedures for boiling systems, and thermal-hydraulic design procedures for boiling water reactors. (M.C.G.)

24932 (CRRP-1087) A COMPUTER STUDY OF REACTOR FUELLING. W. M. Barss (Atomic Energy of Canada Ltd., Chalk River, Ont.). May 1962. 50p. (AECL-1528)

The Datatron computer was used to simulate the operation of the NPD reactor from startup to fueling equilibrium. At startup about 5% of the fuel charge consists of special slugs which contain partially depleted uranium and are located so as to give the desired reactivity with fresh fuel after the growth of short-lived fission products. The fuel is then shifted systematically to compensate for the subsequent slow change of reactivity of the fuel with irradiation. The one-group neutron diffusion equation was solved in two dimensions for cylindrical geometry, with three adjustments made to match the flux distributions to the results of experiments and two-group treatments. The calculations take into account the effects of irradiation and initial depletion on the following local properties: the buckling, the moderator temperature coefficient of reactivity, the flux depression in the fuel, and the heat output of a fuel slug per unit average flux in the element of core volume associated with a fuel slug. Under the best system of fuel management tested, the addition of new fuel can be deferred for about 400 full power days without an excessive increase in the rate of fuel shifting. Information obtained during startup of the reactor is not included. (auth)

24933 (DC-60-6-722) LOW POWER FLUX MAP AND POWER CALIBRATION OF SUSIE REACTOR. R. F. Brenton (General Electric Co. Aircraft Nuclear Propulsion Dept., Idaho Falls, Idaho). June 13, 1960. Contract AT(11-1)-171. 60p.

Measurements for a flux map of the Susie reactor using gold foils are presented. Data from a reactor power determination are included. (J.R.D.)

24934 (DC-60-11-103) ELECTRICAL RESISTANCE AS AN INDICATOR OF FUEL ELEMENT CRACKING. R. E. Schmidt (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Nov. 16, 1960. Contract AT(11-1)-171. 11p.

Measurements were made on a simulated fuel element to determine what effect partial occlusions, normal to the cross section, have on the end-to-end electric resistance of the element. Calculations based on the results show that it is probably feasible to use electric resistance as an indicator of crack occurrence. (J.R.D.)

24935 (DC-61-2-97) PROGRAM ODD–A ONE-DIMENSIONAL MULTIGROUP REACTOR ANALYSIS PROGRAM FOR THE IBM-704. P. G. Fischer, F. D. Wenstrup, and T. A. Hoffman (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Feb. 10, 1961. Contract AT(11-1)-171. 60p.

An initial users manual is presented for Program ODD, a one-dimensional multigroup diffusion theory, reactor analysis program which utilizes the revised ANP nuclear data system. The physical and mathematical models used in the calculations are discussed, but complete program documentation was postponed until after the installation of the IBM-7090 computer. The primary advantage of the program over

existing ANP multigroup calculations is the consistent treatment of nonisothermal reactors which is obtainable on a routine basis without the usual convergence difficulties associated with the presence of "up-scattering" reactions. (auth)

24936 (GEAP-4012) ANALYSES OF THE RADIAL SEPARATOR. C. H. Robbins (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Feb. 6, 1962. Contract AT(04-3)-189. 19p.

A mathematical analysis is presented concerning the performance of the radial or vane type steam separator. The analyses are concerned with the spread of flow on the vanes because of centrifugal force (which requires that the vane height be greater than the nozzle), and with separation of the vapor from the liquid. (J.R.D.)

24937 (HW-70400) DISCUSSION OF RUPTURE MODEL WITH EMPHASIS ON EVALUATION OF EXPOSURE EFFECT. J. L. Jaech (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 17, 1961. Contract AT(45-1)-1350. 12p.

The techniques used to evaluate the exposure effect in the rupture model are discussed, and the rupture model is reviewed. Estimation of parameters is described. (M.C.G.)

24938 (HW-71649) FRENCH AND BRITISH METHODS IN REACTOR THEORY. J. R. Triplett (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 9, 1961. Contract AT(45-1)-1350. 23p.

A variational principle for thermal neutron spectra is presented in terms of the eigenfunctions of the thermalization operator. The Laplace transform method for neutron spectra is discussed. A generalized heavy gas thermalization model for neutron spectra is outlined. Monte Carlo sampling procedures for thermal neutron scattering calculations are given. Leakage and thermalization in uniform heterogeneous lattices are discussed. (M.C.G.)

24939 (HW-SA-2548) DECONTAMINATION OF PRESSURIZED-WATER SYSTEMS (thesis). Ronald D. Weed (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). 1962. Contract AT(45-1)-1350. 175p.

Submitted to Washington. Univ., Seattle.

Pressurized water-cooled reactors require periodic decontamination for continuity of operation and maintenance. A general decontamination procedure was developed involving an oxidizing hydrogen peroxide solution for dissolution of the uranium oxides, an alkaline permanganate solution for film conditioning, and an acidic solution for film removal. The procedure evaluated utilized the following solutions: a peroxide-bicarbonate solution, an alkaline permanganate solution, and a dibasic ammonium citrate solution. The decontamination process, as it was developed during the evaluations, is an effective procedure for decontaminating stainless steel, carbon steel, or mixed carbon steel-stainless steel reactor systems. Laboratory studies, ex-reactor loop studied, and in-reactor loop studies were conducted with this decontamination procedure. Decontamination effectiveness and corrosivity of the process are discussed. A review of decontamination and a discussion of the equipment, test procedures, samples, sample preparation, and basic limitations set for the evaluations are included. Research areas for further process improvement are given. (auth)

24940 (IDO-11052) ORGANIC COOLANT RECLAMATION. Quarterly Progress Report No. 11, December 15, 1961 to March 15, 1962. D. A. Scola, J. S. Adams, and C. C. Richiusa (Monsanto Research Corp. Boston Labs., Everett, Mass.). Apr. 15, 1962. Contract AT(10-1)-1088. 36p.

Coolant reclamation studies were devoted to process development and product evaluation. The solvent distribution process for reclaiming both OMRE Core I and OMRE Core II high boiler and spent coolant was extended to formulated spent coolant mixtures containing 5, 10, 30, 40, and 50 wt % high boiler. Fractionation of the high molecular weight fraction from the low molecular weight fraction (reclaimed coolant) was achieved in all cases. Cost calculations show that spent coolant containing 20 wt % or greater high boiler (HB) would be economical to reclaim. Economic evaluation shows that at these HB concentrations, the solvent distribution reclamation process gives a yearly profit of about $750,000 and a per cent return on investment of 38 to 50%. In addition, several blends of solvents were used to reclaim Core II high boiler and spent coolant. These results make the process more general so that it is not dependent on present solvent compositions or sources. The results also showed that isooctane (branched chain aliphatic) does not give maximum yields of reclaimed coolant. Electron irradiation on Santowax-omp solutions of reclaimed high boiler gave residue values (after distillation) which were decreased by 40 to 50% compared to residue values from the m-terphenyl blank. Wiped-film distillation of OMRE Core II high boiler gave a 27% yield of reclaimed coolant at its maximum temperature (323°C) and minimum pressure (0.5 mm Hg). An economic evaluation of this process gives a profit of $322,000 per year when compared to the case where high boiler is discarded and replaced with new terphenyl. Optimum conditions for hydrocracking 15.8% partially reduced high boiler using copper chromite catalyst were obtained. The process can operate from 495 to 550°C, at 500 to 1500 psig, and with a liquid hourly space velocity of 1.8 to 4.8 hr^{-1}. The process is characterized by low coke formation under all conditions. A six-hour run gave a coke yield of 0.4 wt %/hour based on feed material. The product showed considerably better coolant properties than high boiler or partially reduced high boiler. Good yields (60 to 80%) of product having low viscosity (0.8 cp at 265°C), low average molecular weight (254 to 350), an increased thermal decomposition temperature (390°C), and low fouling tendency (~5 mg) were obtained. Cost evaluations of a 60, 70, and 80% yield process show a profit of −$142,000, +$110,000, and +$259,000 per year when compared to the process where high boiler is burned and replaced with new terphenyl. The fundamental aspects of the coolant program have begun. Dihydroresorcinol ethylenol ether (680 g), 3-phenylcyclohexen-2-one (200 g), and 3-bromo-ethylbenzene (140 g), intermediates in the synthesis of mono-methyl and -ethyl terphenyls and 1-phenyl-3-xenyl-cyclohexadiene-1,3 (dihydroquaterphenyl) were synthesized. The radiation and thermal stability of the methyl- and ethyl terphenyls as well as the fouling ability will be determined. (auth)

24941 (IDO-11101) ORGANIC MODERATOR-COOLANT IN-PILE IRRADIATION LOOP FOR THE MIT NUCLEAR REACTOR. Progress to July 1, 1961. E. A. Mason, W. N. Bley, and D. T. Morgan (Massachusetts Inst. of Tech., Cambridge). July 1, 1961. Contract AT(10-1)-1067. 43p. (MITNE-7)

Out-of-pile testing of the in-pile assembly and associated equipment was completed for in-pile testing of Santowax OMP at 600°F and 100 psig. The program at MIT was expanded to include the responsibility for all the analytical work to be carried out as part of the over-all evaluation of the performance of irradiated coolants. The techniques for

measuring the chemical and physical changes induced by radiation were developed or are in advanced stages of development. Several of the analytical techniques to be used in this program are described. Heat transfer measurements on irradiated Santowax OMP were completed. The application of the "Wilson Method" to measure fouling is described and the planned heat transfer program is outlined. Calorimetry measurements were completed in the central fuel element position which the in-pile assembly will occupy. The total dose rate to unirradiated Santowax OMP at 600°F at the reactor midplane was determined from the calorimetry measurements to be 0.33 watts/gm at 1 Mw of reactor power. The fast neutron dose contributes 33% of the total dose. It is expected that the reactor will be operating at a 2 Mw power level during the irradiations; therefore, the dose rate will be increased by a factor of two to 0.66 watts/gm. (auth)

24942 (KR-20) APPLICATION OF ANALOGUE COMPUTER TO NUCLEAR REACTOR BURN-UP STUDIES. W. A. Raaymakers and R. J. J. Stamm'ler (Norway. Institutt for Atomenergi, Kjeller). Apr. 1962. 24p.

A computer code that facilitates burnup studies on the specific case of a batch irradiated fuel load is presented. The assumption of a uniform and time varying flux was made. Scaling of the equations was necessary to adapt them to the PACE Computer. The computer diagram is given, and a working example is described. (auth)

24943 (MND-C-2500-3) APWRC-SYNFAR-02, A P1 AND DSN THEORY. FORTRAN-II CODE FOR STATIC AND DYNAMIC SYNTHESIS OF TWO-DIMENSIONAL FLUX AND REACTIVITY. T. M. Olsen (Martin Co. Nuclear Div., Baltimore). May 1962. Contract [AT(30-1)-2431]. 77p.

A computer code, APWRC-SYNFAR-02, was programmed in FORTRAN II for synthesis computation of static flux and reactivity, or of stable period and corresponding flux shape in XY or RZ geometry on the IBM 7090. It also allows direct computation of the same quantities in one-dimensional spherical geometry. Running time is 12 minutes or less. (M.C.G.)

24944 (MND-C-2500-4) APWRC-SYBURN, A FORTRAN-II PROGRAM FOR SYNTHESIZED TWO-DIMENSIONAL P1 OR DSN BURNUP CALCULATIONS. E. A. Colbeth and T. M. Olsen (Martin Co. Nuclear Div., Baltimore). June 1962. Contract AT(30-1)-2431. 62p.

The reactor physics neutron code, APWRC-SYBURN, was designed for the IBM 7090 and written in FORTRAN-II. It was developed for one-dimensional regionwise or intervalwise determination of isotope concentrations during reactor burnup, including effects of rod or other control eigenvalue variation, providing core averaged radial constants for subsequent synthesized axial burnup problems. Typical running time is 2 to 7 minutes. (M.C.G.)

24945 (MND-C-2500-5) APWRC-GAMICO, A MODIFICATION OF GAM-I FOR APPLICATION TO THE ARMY PRESSURIZED WATER REACTOR CODE. G. A. Cannon, R. S. Hubner, and T. M. Olsen (Martin Co. Nuclear Div., Baltimore). June 1962. Contract AT(30-1)-2431. 37p.

The computer code APWRC-GAMICO was developed for calculating the slowing-down spectrum in either the P-1 or B-1 approximation on the IBM 7090. The program, coded in FORTRAN-II, uses 68 groups of neutrons with a constant group width of $\Delta u = 0.25$. The calculated flux and current spectra were used to reduce the original 68-group cross-section data to average values over as many as 32 broad groups. Typical running time is about one minute. (M.C.G.)

24946 (NAA-SR-Memo-4325(Rev.1)) EFFECT OF REACTOR CORE LENGTH ON HEAT TRANSFER HYDRAULIC, AND OTHER CORE PARAMETERS. T. T. Shimazaki (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Jan. 18, 1962. Contract [AT(11-1)-Gen-8]. 14p.

A generalized plot of the effect of channel length on heat transfer, hydraulic, and other core parameters is presented for the condition of fixed coolant inlet, coolant outlet, and maximum surface temperatures. The plot should be useful in reactor optimization and extrapolation studies. For the two cases of particular interest, specific power held fixed and pressure drop held proportional to channel length, increasing the channel length resulted in an increase in channel equivalent diameter, pressure drop, heat flux, heat transfer coefficient, mass velocity, and thermal stress. For the second case increasing the channel length resulted in a decrease in the specific power. (auth)

24947 (NAA-SR-Memo-6907) CRITICAL HEAT FLUX OF SANTOWAX R IN FORCED CONVECTION. J. M. Robinson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 4, 1962. Contract [AT(11-1)-Gen-8]. 23p.

The critical heat flux of Santowax R was measured for upflow in a 0.344-in. ID vertical tube as a function of velocity, subcooling, and pressure over the following ranges: V = 4 to 17 ft/sec, P = 30 to 150 psia, ΔT_{sub} = 130 to 280°F, and T_{bulk} = 590 to 850°F. The data were correlated by the equation $(Q/A)_c = 548\ \Delta T_{sub}\ V^{1/3} + 145{,}000$ Btu/hr-ft.^{2} (auth)

24948 (NAA-SR-Memo-7212) FUEL HANDLING MACHINE SHIELDING REQUIREMENTS FOR SRE CORE III. W. A. Schumann (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Mar. 7, 1962. Contract [AT(11-1)-Gen-8]. 20p.

Dose rates at various receiving points adjacent to the SRE fuel handling machine were calculated, assuming that the fuel element was exposed for a long time at peak power conditions in the SRE (PEP). It was further assumed that handling occurs 10 hours after reactor shutdown. Streaming underneath the fuel handling cask, while the element is being raised into it, was considered not to be a problem, for if excessive, such a condition could be alleviated by means other than just adding to the thickness of the cask wall. The maximum allowable heat flux of the SRE (PEP) design is set at 10^6 Btu/hr-ft^2 and calculations for obtaining source strengths were based on this number. Dose rates at each of the four points chosen were calculated for various thicknesses of lead and the results are summarized in graphs. From these figures it is clear, for example, that with an approximate equivalent thickness of 10" of lead, as exists in the present fuel handling cask, the dose rate at point 1 will be 2097 mr/hr which is far above the allowable rate of 7.5 mr/hr (or 2.5 mr/hr average) for a 40 hour work week. If, for instance, the allowable dose rate is 2.5 mr/hr at the surface of the cask the thickness of lead required in the region of point 1 will be 15.1 in. Similarly, 12.4 in. is needed at point 2, 11.5 in. at point 3, and 10 in. at point 4. It is doubtful that the operator will ever be in contact with the cask at points 2, 3, and 4 and the shielding at these locations may be made somewhat thinner than suggested above. (auth)

24949 (ORNL-TM-189) REACTIVITY CALIBRATIONS AND FISSION-RATE DISTRIBUTIONS IN AN UNMODERATED, UNREFLECTED URANIUM–MOLYBDENUM ALLOY RESEARCH PROGRAM. J. T. Mihalczo (Oak Ridge National Lab., Tenn.). May 10, 1962. Contract [W-7405-eng-26]. 19p.

Completion of zero-power critical experiments with the ORNL Health Physics Research Reactor is reported. A description is given concerning these experiments which were used to determine the critical size, fission-rate distributions, reactivity calibrations of its movable parts, the temperature coefficient of reactivity, and the reactivity effects of the presence of neutron-reflecting materials adjacent to the reactor. (J.R.D.)

24950 (ORNL-TM-250) IN-PILE GAS-COOLED FUEL ELEMENT TEST FACILITY. J. Zasler, W. R. Huntley, P. A. Gnadt, and T. S. Kress (Oak Ridge National Lab., Tenn.). July 10, 1962. Contract W-7405-Eng-26. 30p.

Paper presented at American Nuclear Society Meeting, June 18-21, 1962, Boston, Mass.

Design and operating problems of unclad and ceramic gas-cooled reactor fuels in high temperature circulating gas systems will be studied using a test facility now nearing completion at the Oak Ridge Research Reactor. A shielded air-tight cell houses a closed circuit gas system equipped for dealing with fission products circulating in the gas. Experiments can be conducted on fuel element performance and stability, fission product deposition, gas clean up, activity levels, component and system performance and shielding, and decontamination and maintenance of system hardware. (auth)

24951 (PRDC-TR-55) MONTHLY TECHNICAL REPORT [ON APDA ACTIVITIES] JANUARY 1962. (Power Reactor Development Co., Detroit). Contract AT(11-1)-476. 22p.

Research progress is reported on fuels and metallurgy ORNL Core B program, chemistry and materials, engineering analysis, graphite, physics, systems, mechanical handling, electrical and instrumentation, and test operations. Results of the airborne dust sampling and analysis program for PRDC in January 1962 are presented. (M.C.G.)

24952 (TID-15913) 12-INCH SODIUM FLOW CONTROLLER. Technical Manual 20357. (Westinghouse Electric Corp. Atomic Equipment Dept., Cheswick, Penna.). [nd]. 116p. Contract AT(11-1)-681.

A manual is presented for the Sodium Flow Controller used in controlling flow to regulate heat transfer in a liquid metal nuclear power plant. A description of the controller, general installation and operational pointers, installation instructions, instructions for dismantling of the Sodium Flow Controller, instructions for assembly of Sodium Flow Controller, list of special tools and fixtures, and repair parts list are given. (M.C.G.)

24953 (AEC-tr-5165) FUEL COMPOSITION FOR HOMOGENEOUS NUCLEAR REACTORS. Olle Lindstroem and Sven Hedmann. Translation of Swedish Patent Application. Dec. 5, 1961. 10p.

Fuel was developed for use in a reactor combining the advantages of two-zone and single-zone reactors by subdividing the reactor into two zones without providing a tight pressure-resisting wall. In one type of such reactors this is brought about with the aid of centrifugal forces. In a modified type, the suspension of breeding material and the solution of fissionable material are supplied to a common chamber in small quantities and delivered to a separator, in order to be again separated there. The solution of fissionable material is returned to the inner circulation system while the suspension of breeding material is delivered back to the outer circulation system. Uranyl sulfate and thorium oxide are used. A way to counteract the adsorption of fissionable material and catalyzing salts by the breeding material without causing a disturbing secondary effect is suggested. One or several salts of aluminum, magnesium, and/or beryllium may be added to the fuel. Eight examples of fuel composition are given. (M.C.G.)

24954 STANDBY EMERGENCY PROTECTION SYSTEMS FOR NUCLEAR REACTORS. P. I. Popov, V. G. Terent'ev, and E. V. Filipchuk. Atomnaya Energ., 12: 497-502(June 1962). (In Russian)

Any emergency system installed in a reactor must be able to stop the operation of the reactor, placing it in an emergency condition, and must also ensure that failure of individual components or assemblies will not interfere with its safe functioning. The reliability is increased by the incorporation of reserve units into the system. In order to obtain a clear picture of the effect of such standby units, quantitative factors were used for evaluating the reliability of reactor systems with and without reserve units. Assuming that the failure of a unit is a random, independent event, the probability of uninterrupted operations, P(t), the probability of interruptions, Q(t), and the hazards presented by the latter, $\lambda(t)$, the probability of satisfactory operation of the i-th element is expressed by the exponential expression: $P_i(t) = e^{-\lambda_i t}$. The probability of a sudden failure of each functional and logical scheme used for emergency protection were evaluated on the basis of such calculations, considering both electron tubes and semiconductor elements. The mathematical analysis indicated that introduction of such standby elements the reliability of which remains constant because they are subjected to low loading, increases considerably the reliability of the overall system. The semiconductor units appeared to be more reliable than the electron tubes. This method may be useful for comparing design variables and thus determining the most reliable schemes. (TTT)

24955 INTERNAL THERMAL COLUMNS FOR AMPLIFYING THERMAL NEUTRON FLUXES IN WATER-MODERATED REACTORS. H. Hulubei, I. Purika, T. Rosescu, and M. Sabau (Inst. of Atomic Physics of the Rumanian Academy of Sciences, Bucharest). Atomnaya Energ., 12: 528-31(June 1962). (In Russian)

If the power level is kept the same, the thermal neutron flux of a reactor containing enriched U and normal water will be higher as in that case the critical mass is lower. These reactors have also considerable epithermal and fast neutron fluxes. An evaluation of the usually used moderators, such as H_2O, D_2O, C, and Be in internal thermal columns by means of the two-group method indicated that light water is the best moderator for the thermal column. Experimental tests were also carried out in the core of the VVR-S reactor of the Institute of Atomic Physics. Results showed that the critical mass increases strongly if the radius of the column exceeds 6 cm. This may be compensated by replacing the water reflector with C, Be, or BeO; in a VVR-S type reactor such an exchange leads to the reduction of the critical mass from 3.2 to 2.5 kg of U^{235}. The internal thermal column is also useful for changing the spectrum, i.e., for reducing the fast-neutron flux as is required for the preparation of certain radioactive isotopes by special nuclear reactions. (TTT)

24956 THE LIFETIME BEHAVIOR OF NONUNIFORM OPTIMIZED REACTORS AND RELATED TOPICS. John Sanford Ingley (Cornell Univ., Ithaca, N. Y.). Dissertation Abstr., 22: 4379-80(June 1962).

It is well known that the initial static properties of a thermal reactor can be improved by constructing it in such a way as to make the thermal flux and/or power density independent of position in the core. Reactors of this type can be built in a number of ways; in particular by nonuniformly distributing the moderator to produce flat flux

and power (a "type 2" reactor), or by nonuniformly distributing the fuel to produce flat power (a "type 4" reactor). Although the static properties of these reactors have been studied in detail, little is presently known about their behavior over lifetime. A two-group burnup study was therefore made to determine the relative merits of each system, and their performances were compared with that of the ordinary uniform reactor (a "type 0" system). The type 2 reactors were found to maintain superior flux and power profiles throughout reactor life, and in most cases exhibit greater lifetimes than either the type 0 or type 4 reactors for comparable fuel loadings. In addition, the type 2 reactors require the least amount of external control in the form of control rod poisoning to produce a given reactor lifetime. The type 4 reactors produce better flux and power profiles throughout reactor life than do the type 0 reactors and require less external control. The type 0 reactors give generally poor performance in the above areas and are unable to compete with the nonuniform reactors in lifetime performance. The generally excellent behavior of the nonuniform reactors over lifetime as compared to the ordinary uniform reactor indicate that substantial gains in reactor technology would result from increased study of these systems.

24957 SAFETY CONSIDERATIONS IN THE INSTRUMENTATION OF REACTORS. Werner Basti. Tech. Überwach., 2: 346-50 (Sept. 1961). (In German)

Control, alarm, and limiting equipment are requested for monitoring the operation of reactors. Safety systems which may work on various principles are employed in order to eliminate, as far as possible, damage to the reactor itself, or dangerous situations for the personnel as well as the environment. Examples illustrate the layout and mode of operation of electric, pneumatic, and hydraulic safety systems and the behavior over the control range. (auth)

24958 NEUTRONIC REACTOR. John Cobb, Charles H. Rice, Wayne L. Ross, and Kenneth W. Sauer (to American Radiator and Standard Sanitary Corp.). U. S. Patent 3,042,595. July 3, 1962.

A boiling reactor is designed in which an increase in boiling results in a desirable increase of reactivity and in which control is facilitated. The reactor has separate coolant and moderator circuits and has means for varying the moderator volume in the core to change the reactivity for increased power or shutdown. As an example of the reactor, a light water-moderated and -cooled reactor with a heat output of 60 Mw is described. (D.L.C.)

24959 SHIELDED THORIUM FUEL ELEMENT. Russell L. Crowther (to General Electric Co.). U. S. Patent 3,042,598. July 3, 1962.

A Th^{232}-containing fuel element is designed for neutron irradiation to produce U^{233}. The element is provided with an outer shield layer to absorb neutrons in the energy range 0.05 to 10.0 ev, thus minimizing neutron absorption by Pa^{233} and improving the breeding efficiency of U^{233} from Th^{232}. The shielding material may be Pu isotopes, U^{238}, or other fissionable or fertile isotopes. Several embodiments of the fuel element (rod, tube, plate, and assembly) are described. (D.L.C.)

24960 REACTOR CONTROL. Robert D. Brooks (to General Electric Co.). U. S. Patent 3,042,600. July 3, 1962.

A control system is designed for controlling the reactivity of a boiling reactor to accommodate changes in load. The control is effected by regulating the flow of moderating coolant through the reactor. (D.L.C.)

Power Reactors

Refer also to abstracts 24419, 24450, 24451, 24453, 24465, 24466, 24467, 24468, 24469, 24470, 24471, 24472, 24473, 24474, 24475, 24476, 24478, 24479, 24480, 24481, 24484, 24492, 24493, 24494, 24497, 24519, 24539, 24545, 24547, 24593, and 24596.

24961 (ACNP-5905) PATHFINDER ATOMIC POWER PLANT SAFEGUARDS REPORT. PART II. LICENSE APPLICATION. (Northern States Power Co., Minneapolis). Jan. 15, 1962. Contract AT(11-1)-589. 521p.

A description of the design and operation of the Pathfinder Atomic Power Plant and its reactor with nuclear superheater is presented. The plant site and the safeguards are reviewed in detail. The review substantiates that the health and safety of the public and operating personnel will be protected by proper plant design and safe operating procedures. Various types of accidents were analyzed in order to verify that adequate safeguards are provided. The reactor for the plant is of the heterogeneous boiling water type with a two-region core. A superheater region in the center is approximately a right circular cylinder surrounded by a boiler region. The fuel elements in the superheater region will contain highly enriched uranium dioxide in a stainless steel cermet clad with stainless steel. The fuel elements in the boiler region will contain slightly enriched uranium dioxide clad with Zircaloy-2. The reactor will operate at a normal pressure of 615 psia. Light water is used as the coolant and moderator and will be recirculated through the boiler region by pumps located external to the reactor vessel. Controlled recirculation will provide an additional means of controlling the output of the reactor. Steam generated at 489°F in the boiler region will be passed through the superheater region raising the temperature for ultimate use in a condensing steam turbine. Specifications for the Pathfinder reactor with the nuclear superheater operating on the basis of a 725°F bulk exit temperature are listed. Various potential and hypothetical hazards and incidents were reviewed and results of analysis are presented. It is shown that the reactor building, which is designed to meet all applicable codes, is structurally stable and capable of withstanding internal pressures resulting from maximum release of steam or coolant. It is also shown that the reactor building is capable of containing radioactive fission products released into the building during any reasonable postulated incident. It was concluded that the Pathfinder Atomic Power Plant will not constitute a hazard to the health and safety of the public and operating personnel. (auth)

24962 (ACNP-62005) PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT, OCTOBER 1961—DECEMBER 1961. (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Apr. 20, 1962. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. 95p.

Technical progress is reported on research and development associated with the design of the Pathfinder atomic power plant. Preconstruction work is reported on fuel elements, reactor mechanical studies, and nuclear analysis. Other design work is reported on the oscillator control rod mechanism, a superheating calorimeter, and superheater thermocouple lead connectors. (J.R.D.)

24963 (AD-269402) LOW MAINTENANCE MACHINERY FOR SUBMARINE POWER PLANTS. APPENDIX 15.

MACHINERY SYSTEMS AND CONTROL CONSIDERATIONS. D. H. Brown (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Dec. 1961. 48p.

Consideration was given to equipment and procedures that will provide submarine machinery for propulsion, auxiliary, and hotel service that will be characterized by: low maintenance afloat; reduction in surveillance afloat; fail-sick in place of fail-dead characteristics; reduced man-hours and down time for most probable service; reduced skill to operate, supervise, trouble-shoot, and replace; reduced apparent complexity through packaged components and functions; enhanced efficiency to prolong cruises; and capability to operate at all speeds at all depths and under high shock loads. (auth)

24964 (ANL-6552) MODIFICATION OF THE EXPERIMENTAL BOILING WATER REACTOR (EBWR) FOR HIGHER-POWER OPERATION. J. F. Matousek, comp. (Argonne National Lab., Ill.). Apr. 1962. Contract W-31-109-eng-38. 229p.

Supplement to ANL-5607.

Alterations and additions made to the Experimental Boiling Water Reactor (EBWR) plant to permit operation at power levels up to 100 Mw(t) are described. Topics covered include over-all system modifications and additions, nuclear component modifications and additions, and reboiler plant component description. (M.C.G.)

24965 (APAE-105) THERMAL ANALYSIS OF TYPE 3 ELEMENTS IN THE SM-1, SM-1A AND PM-2A CORES. S. L. Davidson and I. Segalman (Alco Products, Inc., Schenectady, N. Y.). Mar. 30, 1962. Contract AT(30-1)-2639. 126p.

A steady state and transient thermal analysis was performed on the Type 3 replacement cores for the SM-1, SM-1A, and PM-2A plants. The fundamental criterion for acceptable thermal design is the minimum departure from nucleate boiling ratio (DNBR). The minimum design DNBR at design power conditions and scram power conditions for concurrent transient and steady state analyses is currently specified at 1.5. The steady state thermal analysis indicated that the SM-1 Type 3 core will operate safely at design conditions of 10.77 Mw and scram power of 13.45 Mw with minimum DNBR's above 1.5. Stationary elements in some peripheral core positions experience local nucleate boiling. The steady state thermal analysis indicated that the SM-1A Type 3 core will operate safely at design conditions of 20.2 Mw and scram power of 24.2 Mw with minimum DNBR's above 1.5. At scram power conditions a minute amount of local nucleate boiling in the hot channel was evident at the exit end of the most critical control rod and stationary element. Results of the thermal analysis indicated that the PM-2A Type 3 core will operate safely at design conditions of 10.0 Mw and scram power of 12.0 Mw with minimum DNBR's greater than 1.5. The analysis of all Type 3 cores showed they are safe during the early critical period (first 3 sec) of a loss of low transient. The corresponding minimum DNBR produced is 1.96 in the SM-1A Type 3 core at the peak power level (scram power level) with the scram mechanism inoperative. Since this minimum DNBR occurs under the severest conditions and the minimum DNBR produced is greater than the design criteria of 1.50, all Type 3 cores are considered thermally safe. Under similar conservative conditions the SM-1 Type 3 core has a minimum loss of flow transient DNBR of 4.08 and the PM-2A Type 3 core has a minimum loss of flow transient DNBR of 4.59. At nominal power levels the SM-1 and SM-1A Type 3 cores indicated local nucleate boiling in the hot channel while the PM-2A Type 3 core indicated no local nucleate boiling. At the scram power level all Type 3 cores indicate steady state local nucleate boiling in the hot channels. However, only the SM-1A Type 3 core indicated any bulk nucleate boiling in the hot channel during the first 5 sec of the loss of flow accident. In the evaluation of the SM-1 Type 3 core it was determined that increasing the flow coastdown time or scramming the reactor due to reduced flow does not appreciably affect the minimum DNBR but helps to impede the bulk fluid temperature rise during the loss of flow transient. (auth)

24966 (APAE-121) HAZARDS REPORT FOR PM-2A CORE II. J. R. Coombe and L. D. Stephenson (Alco Products, Inc., Schenectady, N. Y.). June 21, 1962. Contract AT(30-1)-2639. 20p.

The changes incurred in the PM-2A by the planned insertion of PM-2A Core II and the replacement of the startup and check sources are described. PM-2A Core II components were fabricated to specifications very nearly identical to those of PM-2A Core I. The essential difference in the cores is the boron loading which permits PM-2A Core II to meet a "one-stuck rod criteria" at beginning of life. This core was subjected to a zero power experiment, and loading procedures were developed at the Alco Critical Facility. The nuclear and thermal and hydraulic characteristics are essentially identical to those of Core I and the replacement of the startup and check sources represent no increase in the potential for or magnitude of a hazardous situation. (auth)

24967 (APEX-800(Pt.A)) GAS-COOLED HIGH-TEMPERATURE NUCLEAR REACTOR DESIGN TECHNOLOGY. I. INTRODUCTION. C. W. Moon. 2. INFLUENCE OF PERFORMANCE REQUIREMENTS ON POWER PLANT COMPONENT SPECIFICATIONS. R. E. Motsinger. 3. REACTOR DESIGN. R. E. Motsinger, C. W. Moon, J. M. Crook, and C. S. Robertson, Jr. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 30, 1962. Contract AT(11-1)-171. 229p.

Design technology for gas-cooled high-temperature nuclear reactors is described by recounting the solutions to reactor design problems used for the direct air cycle portion of the national Aircraft Nuclear Propulsion (ANP) Program. Major shield and control system design problem solutions as related to the reactor are also recounted. General characteristics of nuclear-powered gas-turbine cycles of gas-cooled reactors and of shields are discussed and means are indicated for relating those characteristics to basic requirements of the nuclear reactor. A general discussion of reactor design, including initial and final design sequences is also presented. (auth)

24968 (APEX-800(Pt.F)) GAS COOLED HIGH TEMPERATURE NUCLEAR REACTOR DESIGN TECHNOLOGY. 8. CONTROL DESIGN FACTORS. T. A. DeRosier (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). June 30, 1962. Contract AT(11-1)-171. 104p.

Design technology for gas-cooled high-temperature nuclear reactors is described by recounting the solutions to reactor design problems used for the direct air cycle portion of the national Aircraft Nuclear Propulsion (ANP) Program. Major shield and control system design problem solutions as related to the reactor are also recounted. In several sections, the control philosophy, design factors, and the design verification are considered. It is noted that these are the three major phases in the design and development of a control system. (J.R.D.)

24969 (CEND-116) EVALUATION OF STEAM SEPARATION REQUIREMENTS FOR LARGE INTEGRAL BOILER-SUPERHEATER REACTORS. J. S. Hucks and V. C. Hall, Jr. (Combustion Engineering, Inc. Nuclear

Div., Windsor, Conn.). Dec. 1960. Contract AT(11-1)-196. 47p.

The steam separation requirements for large integral boiler-superheater reactors were evaluated in light of steam separation information obtained from a survey of available literature. Separation theory, development of conventional steam separation equipment, development of nuclear steam requirements, and test program requirements are discussed. (J.R.D.)

24970 (CEND-135(Vol. I Suppl.)) PL FINAL DESIGN REPORT. SUPPLEMENT. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). [1961]. Contracts AT(10-1)-967 and AT(11-1)-1062. 25p. (IDO-19030, Vol. I Suppl.)

The design of the Army Reactor PL refueling equipment is described. Details of refueling procedures are also given along with a definitive hardware design for the radioactive gas handling equipment which is described in report IDO-19030. (J.R.D.)

24971 (CEND-150(Pt.I)) ADVANCED INDIRECT CYCLE WATER REACTOR STUDIES FOR MARITIME APPLICATIONS. PART I. COST ANALYSIS AND FUTURE DEVELOPMENT. (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Apr. 1962. Contract AT(30-1)-2760. 74p. (NYO-9949(Pt.I))

The competitive position of nuclear energy as a source of commercial propulsive power was determined within the economic framework of 43,000 DWT class, American-built tankers. The current status of indirect-cycle, water reactor plants was assessed by comparing estimated costs for the presently attainable, second-of-a-kind nuclear ships with the cost of a conventional tanker powered by an oil-fired marine boiler. The two nuclear systems differ in that one utilizes latent heat instead of sensible heat for superheating and is more compact. The short-range and longer-range potentials for this application of nuclear energy were assessed by predicting the effect of evolutionary developments and the influence of full industrial participation. The evaluations of both the current and future status were made by computing annual operating costs for two trade routes—a long voyage to Kuwait on the Persian Gulf from the U. S. East Coast and a shorter trip along the U. S. East Coast. It was concluded that a competitive nuclear tanker can be constructed in the foreseeable future if emphasis is given to developing the proper present day concepts. A research and development program outlining the key areas for future work was formulated. It was recommended that this program be conducted before pursuing a cooperative ship building program with the maritime industry. (auth)

24972 (CVNA-138) CVTR CONTROLLED PLANT STUDY. H. H. Norman and J. M. Gallagher, Jr. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Mar. 1962. For Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C.). Contract [AT(30-1)-2589]. 64p.

A study was made of the transient response of the CVTR plant. The main objectives were to evaluate the proposed reactor controller, to determine the effect of the superheater on transient response, and to provide information from which certain set-points in the primary loop can be determined. The nuclear steam generator was simulated on an analog computer. Various transients were imposed on this system and the response of pressure, power and temperatures were recorded. (auth)

24973 (CVNA-141) SUMMARY REPORT OF THE CVTR ZIRCALOY-4 PRESSURE TUBE FABRICATION DEVELOPMENT AND MECHANICAL PROPERTIES. E. Landerman, J. R. Reavis, G. H. Eng, W. Smalley, and G. J. Bohm (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). June 1962. For Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract AT(30-1)-2289. 125p.

The fabrication methods, mechanical properties, and test programs pertinent to the design and construction of the zircaloy-4 pressure tubes for the CVTR are described. (auth)

24974 (DC-55-7-61) START-UP INSTRUMENTATION. L. M. Tupman (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). July 15, 1955. Contract [AT(11-1)-171]. 36p.

Startup instrumentation for the HTRE-1 is described. Included are test results, calibration adjustments, and maintenance voltage charts. The prototype of this equipment was operated in the controls mockup. (auth)

24975 (DC-60-10-154) FOREIGN GAS COOLED REACTORS. F. E. Mehali (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Oct. 14, 1960. Contract AT(11-1)-171. 8p.

A compilation of information on gas cooled reactors located outside the U. S. is presented. Key design information is tabulated on reactors in operation, under construction, and planned in seven nations. (J.R.D.)

24976 (DC-60-10-726) PROCEDURE, MATERIAL, EQUIPMENT AND FACILITIES REQUIREMENT FOR DECONTAMINATION OF D140E-1 POWER PLANT. Gene G. Plastino (General Electric Co. Aircraft Nuclear Propulsion Dept., Idaho Falls, Idaho). Oct. 13, 1960. Contract AT(11-1)-171. 32p.

An outline is presented concerning the methods, procedures, materials, equipment, and requirements for remote and/or manual decontamination of the X-211 turbomachinery. Discussions are included concerning chemical and physical aspects of the plate-out particulate, material classification, decontamination solutions, and equipment. (J.R.D.)

24977 (DC-61-6-16) D102A POWER PLANT DISASSEMBLY PROCEDURE. John W. McVey (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Oct. 16, 1959. Contract AT(11-1)-171. 57p.

The proper steps and sequence to disassemble the D102A Power Plant in a safe, pre-determined manner are listed. (M.C.G.)

24978 (DL-49) GIANT POWER: PLANNING THE CONTRIBUTION AND GROWTH OF NUCLEAR POWER. W. B. Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Apr. 6, 1962. Revised Apr. 24, 1962. 11p. (AECL-1516)

Presented at the 22nd Annual Meeting of the Northwest Public Power Association, Victoria, British Columbia, April 16-18, 1962.

The growth of nuclear power in the United States and Canada is evaluated and discussed. Factors discussed regarding this subject are economic choice, electric power demand, reactor fuel potential, reactor design, siting nuclear power plants, and development of nuclear programs. (N.W.R.)

24979 (DLCS-1470107(Rev.)) DETERMINATION OF REACTOR COOLANT SYSTEM PRESSURE DROP. CORE I, SEED 3. Test Evaluation. (Duquesne Light Co., Shippingport, Penna.). First issue, Jan. 25, 1962. Second issue, June 27, 1962. Contract [AT(11-1)-292]. 23p.

Tests were carried out to determine the reactor coolant system pressure drop and flow characteristics at periodic intervals. The fast speed performance characteristics for

all four reactor coolant pumps compared closely with the manufacturer's predicted data. The reactor pressure drop during performance of this test agreed closely with the predicted data during both fast speed and slow speed operation. (M.C.G.)

24980 (DLCS-5000562) MONTHLY OPERATING REPORT, MAY 1962. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 52p.

Operations of the Shippingport Pressurized Water Reactor are reported. Topics covered include summary of operations, station performance, incidents, chemistry, health physics, maintenance, test program, training program, and construction and major modifications. (M.C.G.)

24981 (GNEC-198) BONUS ZERO POWER CRITICAL EXPERIMENTS AND APPLICATION TO THE REACTOR DESIGN. Terminal Report. (General Nuclear Engineering Corp., Dunedin, Fla.). Feb. 10, 1962. Contract AT(40-1)-2674. 332p.

An extensive program of full-scale critical experiments was conducted to investigate the physics characteristics of nuclear mockups of the BONUS reactor. The nuclear mockups studied were a cold-clean mockup and a simulated hot-operating mockup. The cold-clean BONUS mockup was precise except for the substitution of aluminum for Zircaloy-2, a 6⅝-inch deficiency in core height in the mockup, and some differences in fuel enrichments. The hot-operating BONUS reactor was simulated by positioning aluminum rods and sheets within the active core regions so as to duplicate the reduced water density in the actual BONUS reactor; the uniform water-density reduction due to temperature and the axially nonuniform reduction due to steam formation in the boiler were simulated. The shims consisted of part-length poison elements placed in the central water holes of some of the boiler fuel boxes (each box contained a 6 × 6 square array of fuel rods with the four central rods missing to form the water hole), and strip-type shims positioned in the water gap between the boiler and the superheater regions. As a result of the cold-clean critical experiments, data were obtained on critical control-rod configurations and reactivity worths, shutdown margins, uniform temperature coefficients and superheater flooding coefficients; the worths of the poison shims and of the enriched fuel in a centrally-located boiler fuel box were also determined. For the simulated hot-operating condition, data were obtained on critical control rod configurations and reactivity worths, and superheater flooding coefficients; in addition, numerous experiments were conducted to map the spatial power distributions corresponding to the various control-rod configurations of interest. The effects of modifications in the shim loading were investigated for both the cold-clean and the simulated hot-operating mockups. Experimental measurements were made on a variety of arrays of boiler fuel boxes; the measurements consisted of determinations of criticality in terms of partial water height and rod-bank position, and the change in reactivity with partial water height. In some of the experiments, boron-polyethylene shims were inserted in the central water hole of each boiler fuel box of a given array to obtain a systematic study of their effect on criticality. Because of the basic differences existing between the BONUS hot-simulated critical assembly and the actual BONUS reactor design, the experimental data are not in every case directly applicable to the BONUS reactor design. In order to permit reliable extrapolation of these data to the BONUS reactor design, an analytical procedure was developed for calculating the important features of the spatial power distributions in the simulated hot-operating critical reactor; for these calculations the control-rod configurations were limited to patterns which preserve symmetry of the power distribution in any octant of the core in any horizontal plane through the reactor. The analytical procedure was checked by a comparison of the calculated data with the experimental data obtained on the hot-simulated mockup. The agreement between calculated and experimental results is good, permitting application of the derived calculational methods to the actual BONUS reactor design. (auth)

24982 (IDO-16775) EOCR CONTROL ROD LATCH RELIABILITY TEST. E. Burroughs and S. Cohen (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Mar. 1, 1962. Contract AT(10-1)-205. 20p.

The final Vard design latch mechanism and hook for the EOCR Control Rod Drive Assembly was successfully and reliably operated in a hot organic medium containing particulates one hundred times the anticipated concentration in the EOCR and with a simulated heavy polymer deposition on all primary latch components. (auth)

24983 (MND-M-1866) PM-1 REACTOR CORE FINAL DESIGN REPORT. R. O. Bagley, F. H. Cox, A. Carnasale, and H. Vener (Martin Co. Nuclear Div., Baltimore). Jan. 1962. Contract [AT(30-1)-2345]. 200p.

The PM-1 water cooled and moderated core contains 741 highly enriched stainless steel cermet tubular fuel elements and 90 lumped B stainless steel burnable poison elements, and it is controlled by 6 Y-shaped europium titanate movable control rods. The core has a lifetime of 1.95 years when operated at its design power level of 9.37 mw of thermal energy. The control of the core is designed so that there is a positive shutdown margin at all times with either one rod stuck completely out of the core or with two rods stuck in the operating condition. The core power is removed by 2125 gpm of pressurized water at an average temperature of 463°F and pressure of 1300 psia. In reactors of this type, the core is stable with a negative temperature coefficient of approximately 2.5×10^{-4} ΔK/K/°F. (auth)

24984 (NAA-SR-Memo-7134) MEASUREMENTS TO DETERMINE THERMAL UTILIZATION IN THE HALLAM EXPONENTIAL LATTICES CONTAINING UC FUEL ELEMENTS. O. R. Hillig (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Mar. 15, 1962. Contract [AT(11-1)-Gen-8]. 54p.

The results of detailed neutron flux distribution measurements, in several lattice cells containing 8-rod UC fuel elements, and values of thermal utilization are presented. These measurements were made in three lattices where the 3 wt % enriched UC fuel elements were in a hexagonal arrangement and in one lattice of fuel elements in a square array. The measurements and the results which lead to the values of thermal utilization are discussed. A description of the lattice cells studied is included along with the results of thermal neutron flux distribution and Cd ratio measurements in graphical form, and the calculated values of thermal utilization using the measured relative flux values. (auth)

24985 (NDA-2561-1) FLOW TESTS OF BR-2 FUEL ELEMENTS. E. Van Muiders and J. DiRende (Nuclear Development Corp. of America, White Plains and Brussels. Centre d'Etudes pour les Applications de l'Energie Nucleaire). Mar. 1, 1958. 68p.

The results of an experimental program in which BR-2 fuel elements are under development are reported. Pressure drop, velocity distribution, and endurance characteristics of each element are presented and discussed. Conclusions concerning the design point operation of these

elements and recommendations for future work are given. (auth)

24986 (ORNL-3224) EFFECTS OF SEISMIC VIBRATIONS ON THE EXPERIMENTAL GAS-COOLED REACTOR. F. J. Witt, D. R. Carver, and R. L. Maxwell (Oak Ridge National Lab., Tenn.). June 22, 1962. Contract W-7405-eng-26. 35p.

The effects of seismic vibrations on the dynamic behavior of a composite system were analyzed. The equations of motion were derived and solved with special emphasis on determining the resulting stresses. The method of analysis thus developed was applied to the composite structure consisting of the core, pressure vessel, and supporting skirt of the Experimental Gas-Cooled Reactor (EGCR). A system with three degrees of freedom was considered in order to determine the effects of an earthquake of the maximum intensity expected in the area surrounding Oak Ridge, Tennessee. The system of equations of motion was solved both numerically and analytically, and the resonant frequencies were determined. The seismic effect was shown to be small when the frequency of the seismic disturbance coincided with a natural frequency of the system. In particular, the shear stresses in the graphite core were shown to be negligible. (auth)

24987 (ORNL-TM-108) PRELIMINARY DESIGN OF A HYDROGEN-COOLED IN-PILE LOOP FOR THE EGCR. C. Michelson, A. W. Culp, and F. H. Neill (Oak Ridge National Lab., Tenn.). July 12, 1962. Contract W-7405-eng-26. 122p.

A discussion is presented concerning the preliminary design and hazards evaluation of a H-cooled in-pile experimental loop for operation in the large double-walled through-tube in the Experimental Gas-Cooled Reactor (EGCR) at Oak Ridge. This loop is designed to permit experimentation with full-scale fuel element configurations up to 1 in. OD, at inlet gas temperatures of 600 to 950°F at 300 psig, and experimental power levels up to 500 kw. The results of a preliminary hazards evaluation indicate that a loop of this type can be safely operated in the EGCR. The flammability hazard is controlled by blanketing all H-filled pipes and components with a sufficient quantity of nonreactive gas, such as He or CO_2, to produce a noncombustible mixture for all credible H-release situations. (auth)

24988 (ORNL-TM-251) SAFETY CALCULATIONS FOR MSRE. P. N. Haubenreich and J. R. Engel (Oak Ridge National Lab., Tenn.). May 15, 1962. Contract [W-7405-eng-26]. 69p.

A number of conceivable reactivity accidents were analyzed, using conservatively pessimistic assumptions and approximations, to permit evaluation of reactor safety. Most of the calculations, which are described in detail, were performed by a digital kinetics program, MURGATROYD. Some analog analyses were also made. None of the accidents which were analyzed lead to catastrophic failure of the reactor, which is the primary consideration. Some internal damage to the reactor from undesirably high temperatures could result from extreme cold-slug accidents, premature criticality during filling, or uncontrolled rod withdrawal. Each of these accidents could happen only by compounded failure of protective devices, and in each case there exists means of effective corrective action independent of the primary protection, so that damage is unlikely. The calculated response to arbitrary ramp and step additions of reactivity show that damaging pressures could occur only if the addition is the equivalent of a step of about 1% dk/k or greater. (auth)

24989 (TID-6702) FUEL ASSEMBLY HANDLING EXPERIMENT FOR THE EXPERIMENTAL GAS COOLED REACTOR. Philip J. Lain and P. V. Goulden (Allis-Chalmers Mfg. Co. Atomic Energy Div., Washington, D. C.). [1959?]. For Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif. Contract AT(10-1)-925. 199p. (RD-0100)

Tests of the EGCR fuel assemblies were conducted to determine handling procedure reliability, fuel assembly structural integrity, and failure modes—for use in design improvement. The simulation experiments include a static test in which a gradually increasing load is applied to remove a jammed assembly, and an impact test in which two assemblies are accidentally impacted. Other simulated conditions were established for a sleeve test consisting of insertion and withdrawal of a single assembly in and out of the transfer tube and the reactor fuel channel, and a channel test consisting of insertion and withdrawal of a full complement of six fuel assemblies and a bottom dummy assembly as the charge-discharge cycle. Conclusions and recommendations are included for each test. (J.R.D.)

24990 (TID-7025(Vol.1)) GUIDE TO NUCLEAR POWER COST EVALUATION. VOLUME 1. REFERENCE DATA AND STANDARDS. (Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif.). Mar. 15, 1962. Contract AT(04-3)-334. 285p.

A guide is presented for use in the preparation of and comparative evaluation of nuclear power plant cost estimates. Topics covered in this volume include: instructions for use, glossary of terms and symbols, references, classification of construction accounts, general requirements for construction cost estimates, ground rules for evaluating nuclear power plants, nuclear power plant characteristics, reactor plant systems block diagrams, reactor plant systems index, descriptions and flow diagrams, and estimator's check lists. (M.C.G.)

24991 (TID-7025(Vol.2)) GUIDE TO NUCLEAR POWER COST EVALUATION. VOLUME 2. LAND, IMPROVEMENTS, BUILDINGS AND STRUCTURES. (Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif.). Mar. 15, 1962. 41p. Contract AT(04-3)-334.

Cost information on land, improvements, buildings, and structures is presented. Topics covered include: building codes, structures and improvements, ground improvements, turbine building, office and service buildings, fuel handling building, radioactive waste building, reactor plant auxiliary building, miscellaneous buildings, reactor building, reactor containment structure, and estimating aids. (M.C.G.)

24992 (TID-7025(Vol.3)) GUIDE TO NUCLEAR POWER COST EVALUATION. VOLUME 3. EQUIPMENT COSTS. (Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif.). Mar. 15, 1962. Contract AT(04-3)-334. 232p.

Information relative to equipment costs, including installation, is presented. Topics covered include: ASME code interpretations, size-cost relationships, reactor vessels, reactor controls, biological shield, reactor coolant system pumps, secondary coolant system intermediate heat exchangers, steam generators and superheaters, pressurizers, primary plant control systems, turbine-generators, cooling towers, and condensers. (M.C.G.)

24993 (TID-7025(Vol.4)) GUIDE TO NUCLEAR POWER COST EVALUATION. VOLUME 4. FUEL CYCLE COSTS. (Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif.). Mar. 15, 1962. Contract AT(04-3)-334. 86p.

Information on fuel cycle cost is presented. Topics covered include: nuclear fuel, fuel management, fuel cost, fissionable material cost, use charge, conversion and

fabrication costs, processing cost, and shipping cost. (M.C.G.)

24994 (TID-7025(Vol.5)) GUIDE TO NUCLEAR POWER COST EVALUATION. VOLUME 5. PRODUCTION COSTS. (Kaiser Engineers. Div. of Henry J. Kaiser Co., Oakland, Calif.). Mar. 15, 1962. Contract AT(04-3)-334. 39p.

Data are presented for determining annual fixed charges based on capital cost estimates, a summary of estimated fuel costs, and cost information for estimating operating and maintenance costs, all for use in the computation of estimated power generation costs. Charts are included which show graphically the effect on unit power generation cost of variations in fixed charge rate and plant operating factor. (M.C.G.)

24995 (TID-15224) MONTHLY OPERATING REPORT, FEBRUARY 1962. VOL. V—ISSUE 2. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 43p.

Operational activities of the station are reported. Topics covered include summary of operations, station performance, incidents, chemistry, health physics, maintenance, test program, training program, and construction and major modifications. (M.C.G.)

24996 (TID-15477) PM-3A NUCLEAR POWER PLANT ACTIVATION OF SECONDARY SHIELDING MATERIAL AND LEACH WATER. A. F. Kalfopulos and P. Jalichandra (Jackson and Moreland, Inc., Boston). Apr. 1962. 150p. Contract [AT(30-1)-2749].

Backfill and leach water activation analyses were performed for the PM-3A Nuclear Power Plant, McMurdo, Antarctica. Two samples of backfill material, obtained from McMurdo, and one sample of leach water were irradiated at the MIT Reactor to establish their total activation. Prior to and concurrent with the experimental study, two analytical studies were performed primarily to determine the activation of the backfill and leach water samples after a 20-year irradiation period and to predict the results of the MITR experiments. Comparison of results indicated that the experimentally determined and analytically predicted gamma activities were in good agreement. The medium-lived activity of backfill sample 2 was roughly two times that of sample 1. On the other hand, the long-lived activity of backfill sample 1 was about three times that of sample 2. The leach water behaved like a pure sodium source. On the basis of quick accessibility to the steam generator tank after reactor shutdown, sample 2 is preferred. The conclusion reached and precautions taken in employing backfill sample 2 as secondary shielding material as stated in the "Secondary Shield Design, NYO-9726," are still valid. The recommended method of handling the leach water is applicable, with the possibility that the required decay time may be less. No foreseeable hazards are contemplated. (auth)

24997 (TID-15734) EFFECTS OF THE MAXIMUM CREDIBLE ACCIDENT RELEVANT TO THE DESIGN OF THE CONTAINMENT SHELL, EXPERIMENTAL LOW-TEMPERATURE PROCESS HEAT REACTOR PROJECT. (Allis-Chalmers Mfg. Co. Atomic Energy Div., Washington, D. C.). Mar. 21, 1960. Contract AT(11-1)-832. 106p.

The effects of the maximum credible accident relative to the design of the containment shell are discussed. The maximum credible accident is defined. The thermal and hydraulic effects of the maximum credible accident on the reactor system were analyzed. The extent to which fuel-rod cladding will melt was estimated. The amount of energy released from the reactor system by the escaping steam and water and by a possible chemical reaction was calculated along with the corresponding pressure rise inside the containment shell. The kinds, amounts, and total radioactivity of fission products released to the atmosphere of the containment shell after the core melts were predicted. (M.C.G.)

24998 (WAPD-MRP-97) PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD, FEBRUARY 24, 1962—APRIL 23, 1962. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Contract AT(11-1)-Gen-14. 127p.

Progress is reported on the pressurized water reactor project. Topics covered include: PWR Core 2, PWR Core 1, reactor physics, metallurgy of core materials, and plant modifications for PWR-2. (M.C.G.)

24999 (WAPD-PWR-TE-98) REACTOR PRESSURE DROP AND COOLANT FLOW IN PWR-1 SEED 2 (DLCS-35801). Test Evaluation. Paul A. Bickel (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Jan. 12, 1962. Contract AT(11-1)-Gen-14. 20p.

A test was performed to obtain data pertaining to the pressure drop and coolant flow characteristics of PWR Core-1 Seed 2 during extended pumping operations at normal operating temperatures and when the plant is at power. Pertinent plant parameters in regard to crud deposition are reviewed. There were no significant time-wise trends in pressure drop or flow rates. (M.C.G.)

25000 (WAPD-PWR-TE-99) CONTROL ROD WITHDRAWAL TRANSIENTS. Test Evaluation, DLCS 2760101; DLCS 2760201. E. A. Wieczorkowski (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Dec. 1961. Contract AT(11-1)-Gen-14. 33p.

Criticality and the average reactor coolant temperature of the Shippingport Atomic Power Station's nuclear reactor is controlled by hafnium control rods. Continuous withdrawal of the control rods, due to equipment malfunction or operator error, can be a potential danger to the reactor core. The reactor protection system provides automatic shutdown of the reactor core and thus limits the extent of accidental control rod withdrawal transients to protect the core. Analog simulation was employed to calculate the reactor plant response to control rod withdrawal accidents and thus determine the reactor shutdown setpoints of the protection system. The adequacy and/or degree of conservatism of the analog simulation in predicting plant response is of considerable importance. Testing was performed at the Shippingport Atomic Power Station to determine the actual plant response to mild control rod withdrawals under controlled conditions. The results of these tests were compared with calculations performed by analog simulation. The comparison of test data with calculations illustrated fairly good agreement or conservative calculations, i.e., calculations indicated greater transient excursions than did plant test data. (auth)

25001 (WAPD-PWR-TE-118) STEAM GENERATOR BLOWDOWN RATE (INTERNAL INSPECTION). Test Evaluation, DLCS-3890201. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). [1961]. Contract [AT(11-1)-Gen-14]. 3p.

A test was carried out to evaluate the effectiveness of various blowdown rates on sludge removal from the secondary side of the PWR steam generators by visual inspection. It was concluded that the blowdown rate of 5500 lb/hr for this period was not sufficient to remove the sludge from the steam generators. On the basis of a visual examination of the boilers, it was recommended that the blowdown rate be increased to 25000 lb/hr every two weeks during Seed 3 operations. (M.C.G.)

25002 (AEC-tr-5161) MOLTEN PLUTONIUM AND URANIUM CHLORIDES AS FUEL FOR FAST BREEDER REACTORS. M. Taube. Translated from p.353-63 of "Proceedings of the Symposium on Power Reactor Experiments, held in Vienna, October 23-27, 1961. Vol. I." (A publication of the International Atomic Energy Agency, Vienna, 1962.) (STI/PUB/51(Vol.I(p.353-63))). 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11264.

25003 (AEC-tr-5198) HYDRODYNAMIC ASPECTS IN PLANNING FOR A HOMOGENEOUS REACTOR WITH A SUSPENDED FUEL. P. Novatny and V. Khamrad. Translated from p.187-95 of "Proceedings of the Symposium on Power Reactor Experiments, held in Vienna, October 23-27, 1961. Vol. I" (a publication of the International Atomic Energy Agency, Vienna, 1962). (STI/PUB/51(Vol. I (p.187-95)). 10p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11257.

25004 (AERE-Trans-888) [PART] 1. A METHOD OF ANALYSIS OF REACTOR SPATIAL KINETICS OF CALDER HALL TYPE REACTORS. A. Takeda. Translated by R. A. Scott from Nippon Genshiryoku Gakkaishi, 2: 175-81 (1960). [PART] 2. A STUDY OF THE TRANSFER FUNCTIONS OF SPATIAL KINETICS IN THE NUCLEAR REACTOR. A. Takeda. Translated by A. Takeda and J. B. Sykes from Ibid., 2: 523-30(1960). 46p.

In the core of a large power reactor the shape of neutron flux distribution tends to be distorted in transient behavior. Especially in the core with positive temperature coefficient, such as the improved Calder Hall type reactor, the distortion becomes unstable to result in divergence or oscillation. In order to control such a reactor the spatial control system should be provided such that control rods are locally divided into several groups and each group of control rods is independently moved to control the local reactivity. Therefore, the kinetic analysis requires a method which can describe the time behavior of neutron flux shape and temperature distribution in the core. A new method using the mode transfer functions which are determined corresponding to spatial eigenfunctions is presented. Applying this method the spatial kinetic analysis can be resolved into each mode kinetic analysis without any spatial consideration. (auth)

25005 DETERMINATION OF THE OPTIMUM INPUT TEMPERATURE OF THE COOLANT IN A POWER REACTOR. D. Grecov, C. Haidug, and A. Soci. Acad. rep. populare Romîne, Inst. energet. Studii cercetări energet., II: 455-67(1961). (In Rumanian)

The double circuit design, in which the primary agent extracts the heat released in the reactor and the secondary agent (water) goes through the thermodynamic cycle of the energy installation, finds a wide range of application in the construction of power reactors. Using various variants of calculation, the effect of temperature t_1 of the primary coolant at its input on the net yield of a power reactor as a function of its nature is analyzed. Coolants such as carbon dioxide, helium, polyphenyls, and water were considered. A formula, deduced from thermodynamic considerations, which permits the simple determination of the optimum value of the parameter t_1 is derived. (tr-auth)

25006 CALCULATION OF THE REHEATING TEMPERATURE OF THE FEED WATER IN POWER REACTORS WITH DOUBLE CIRCUIT DESIGN. D. Grecov and C. Haiduc. Acad. rep. populare Romîne, Inst. energet. Studii cercetări energet., 11: 627-37(1961). (In Rumanian)

Formulas are proposed which permit the calculation of the optimum reheating temperature of the feed water for a double circuit, and the results of the calculation variants made in the case of a reactor having a thermal power Q= 400 Mw are given. The application of the formulas proposed avoids the necessity of a large number of calculations and allows the optimum zone of the reheating temperature to be determined with sufficient approximation, while emphasizing the effect of various factors of the thermal design on the parameters studied. (tr-auth)

25007 DETERMINATION OF THE MOST SATISFACTORY PARAMETERS FOR GAS-COOLED ATOMIC POWER STATIONS. L. S. Sterman and V. P. Protsenko. Atomnaya Energ., 12: 488-96(June 1962). (In Russian)

Achievement of maximum efficiency is not the only criterion to be considered when the criteria of atomic power stations are determined; conditions corresponding to the highest utilization of the heat-transfer agent may actually prevail at various power levels of the reactor. For this reason, the power level must be set in order to define the other criteria. Under stable flow conditions of the heat-transfer agent the relationship between thermal utilization efficiency, the heat capacity of the steam generator, and the operating temperature of the system may be determined. While calculating the cost of the overall power station, it must be assumed that certain construction costs are fixed. At a constant power level the most economical conditions actually correspond to those of the optimal thermal utilization. If the power level is not set, when the fuel component is increased, the optimal temperature at the exit of the steam generator will increase and correspondingly the temperature of the gas leaving the reactor and the thermal utilization index will be increased. Calculations are presented for determining optimal conditions when the thermal power of the reactor is limited by the maximum permissible temperature at the surface and within the fuel elements and the power level itself remains to be determined freely, together with the other parameters. (TTT)

25008 NUCLEAR ICEBREAKER "LENIN" IN ARCTIC. V. I. Neganov and B. Ya. Gnesin. Sudostroenie, No. 8, 1-7 (Aug. 1962). (In Russian)

The design and performance of the icebreaker Lenin are described and basic characteristics are given. The length of the icebreaker is 134 m, the width 27.6 m, draft 9.2 m, hull displacement 16000 tons, turbine output 44000 hp, cruising speed in water 18 knots, energy supply 2.75 hp/ton, forward propeller thrust in mooring 330 ton, steam capacity 360 ton/hr, steam temperature 310°C, and pressure 28 atm, steam capacity of the auxiliary boilers 10 ton/hr, auxiliary power 6200 kev, and traveling capacity 1 yr. (R.V.J.)

25009 THE FIRST VOYAGE OF "LENIN" TO ARCTIC. A. N. Stefanovich. Sudostroenie, No. 8, 8-10(Aug. 1962). (In Russian)

The ice conditions and the performance of the Lenin during its first voyage are described. Power plant performance and radiation protection were monitored under various operating conditions. (R.V.J.)

25010 SAFETY IN NUCLEAR POWER INSTALLATIONS. Adolf Birkhofer. Tech. Überwach., 2: 350-2(Sept. 1961). (In German)

A thermal power reactor is safe if its design ensures that the reactor core is not damaged if operating trouble occurs. The excess multiplication constant and shut-down reactivity, as well as the effect of neutron poisons, can be determined in advance for the conditions which might arise

in the event of conceivable reactor accidents. Equally, the heat flow and danger coefficients must be computed or experimentally determined, so the nuclear safety of dynamic processes can be judged. (auth)

25011 MODERN DEVELOPMENT IN THE AREA OF BREEDER REACTORS. Peter Engelmann (Kernforschungszentrum, Karlsruhe, Ger.). Umschau Fortschr. Wiss. u. Tech., 6: 161-6(Mar. 1962). (In German)

A brief review is given of the most recent designs for thermal and fast breeder reactors. The power, neutron flux, fuels, and state of development of fast breeder reactors are tabulated. (J.S.R.)

25012 THE PROBLEMS OF NUCLEAR ENERGETICS. A. P. Aleksandrov. Vestnik Akad. Nauk SSSR, 32: 20-32 (May 1962). (In Russian)

Power stations based on atomic energy are considered seriously even in countries in which the coal and oil supplies are abundant. One of the chief methods of making use of the energy of atomic fuels involves the direct utilization of the fission energy of U^{235} without taking advantage of the excess neutrons; these "burner reactors" are useful for power stations located in areas in which the fossile fuel supplies are expensive or for supplying the atomic icebreaker "Lenin." In a second type of reactors, the neutrons are also used to create new fuel from fertile materials such as U^{238} or Th^{232}. This "breeding" principle is used in many reactor designs all over the world,—in the Soviet Union at the Novovoronezh and the Beloyarsk power stations where nuclear superheat is also used, and in reactors built in East Germany and in Czechoslovakia. By the end of the century, the fast-breeder reactor will probably play a very important role in energy generation. A 5000-kw experimental fast reactor was placed in operation 3 years ago. Scientific problems of special interest for the nuclear technology include: the experimental determination of the neutron-physical constants of fissionable and structural materials, breeding conditions, reactor control problems, determination of neutron fluxes, etc. Experimental reactors, accelerators, electromagnetic isotope separators, and complex neutron spectrometers are used in these studies. (TTT)

Research Reactors

Refer also to abstracts 24341, 24423, 24487, 24488, 24491, 24505, 24520, and 24548.

25013 (BLG-69) MEAN THERMAL CROSS SECTIONS AND HOMOGENEOUS BURNUP OF THE BR2 REACTOR. A. W. Eitz (Brussels. Centre d'Étude de l'Énergie Nucléaire). Oct. 1961. 38p.

In order to calculate thermal constants and burnup effects for the case of a unit cell of the BR2 reactor, some autocode programs for the "Ferranti-Mercury" digital computer were developed. The physical basis and the application of these programs is described; the most important results thus obtained are given in form of tables and figures. Due to the strongly heterogeneous reactor core, rough simplifications could not be avoided. (auth)

25014 (BLG-99) BR2: THE MAXIMUM CREDIBLE ACCIDENT WITHOUT SODIUM COMBUSTION. G. Penelle (Brussels. Centre d'Étude de l'Énergie Nucléaire). Jan. 1962. 23p.

The maximum credible accident of the BR2 reactor was previously studied; the combustion of 75 kg of sodium, used in the reactor for experimental purposes, was assumed. However, it is very sure that sodium normally will not be present in the reactor; the consequences of the maximum credible accident without sodium were therefore studied. As far as the BR2 reactor is concerned, a step change reactivity insertion of 1.3 to 1.9% would result in a nuclear runaway with the following consequences: the fuel elements would be heated beyond the melting point and it was assumed a temperature as high as 1200°C can be reached; at such a temperature, an aluminium-water reaction could occur; and this chemical reaction would release hydrogen which could react with the oxygen of the air. (auth)

25015 (CNEN-134) COMANDO DI UNA TELECAMERA PER LA SALA STRUMENTI DEL REATTORE ISPRA-1. (Operation of a Television Camera for the Control Room of the Ispra-1 Reactor). A. Pulacci and R. Tasselli (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratorio Ingegneria e Servomeccanismi Reattori, Ispra). Mar. 1962. 21p.

When the operator is doubtful about the indications given by the repeaters located in the control room, it is necessary to rapidly compare the indications of the primary instruments. A closed circuit industrial television can be employed as a reading means. The trial scanning is not acceptable for two reasons: the operation is slow and there is a lack of safety due to the possibility of a wrong reading. Equipment which allows the automatic control of a TV camera and the simultaneous adjustment of the focus of the TV camera is described. The adjustment is obtained by employing 3 position servomechanisms with the input voltages chosen by a pushbutton switch. (auth)

25016 (DOFL-TM-60-27) TRIGA DOSIMETRY. [PART] I. Philip G. Berman (Diamond Ordnance Fuze Labs., Washington, D. C.). Sept. 14, 1960. 30p.

The time-integrated neutron fluxes available from the TRIGA Reactor are described. The measurements of neutron flux across the face of and through the height of the reactor core are recorded. Typical maxima available are 10^{13}(S) neutrons per square centimeter across the reactor and 5×10^{13}(S) neutrons per square centimeter at the geometric center of the fuel slugs in the F ring. (auth)

25017 (IDO-16761) ORGANIC COOLANT REACTOR PROGRAM QUARTERLY REPORT, OCTOBER 1–DECEMBER 31, 1961. (Phillips Petroleum Co. Research Div., Bartlesville, Okla.). Mar. 30, 1962. Contract AT(10-1)-1080. 117p.

Progress is reported on the organic-cooled reactor program under the topics: organic coolant research, EOCR experimental projects, and EOCR operations. Separate abstracts were prepared for each topic. (M.C.G.)

25018 (IDO-16761(p.1-74)) ORGANIC COOLANT RESEARCH. J. C. Hillyer, P. S. Hudson, et al. (Phillips Petroleum Co. Research Div., Bartlesville, Okla.).

In the large irradiated circulating loop conditions for deposition of film from OMRE coolant were confirmed by repeated tests and the absence of film formation in Santowax free of high boiler and iron particles demonstrated. Tests at velocities from 3 to 9 feet per second showed that film thickness was inversely related to the 0.9 power of the velocity. A simpler loop was assembled, incorporating the 1.75-in.-thick irradiation cell, and an irradiated survey (rocking) cell was put into service which corrects several disadvantages in the one formerly in use. A technique for the removal of films from test plates by ultrasonic vibrations was developed and extensive studies of film composition were initiated. Kinetic rate constants for electron irradiation of several polyphenyls were determined and it is now found that second order rate constants best describe

the decomposition. Further work and calculations on the partial rates of radical formation and attack of the o,m, and p-isomers of the polyphenyls were performed. The synthetic program to produce pure samples of the polyphenyls was continued, with production of important and difficult intermediates, and one new hexaphenyl completed. Data obtained in the static pyrolytic capsule indicated that the constituents of the coolant used were equally of importance with the iron particulate content in forming film. High boiler from coolant was separated by fractional precipitation with solvents and one small fraction was found which caused the same amount of fouling when present at only 0.2% as does 20 to 30% of total high boiler. Chemical studies of these fractions and others from coolants, high boiler, and film are progressing. In the study of radiation stabilizers, intensive work on the use of sulfur continued. Difficulties in sampling and analysis have so far prevented attaining an accurate material balance on the fate of the sulfur. Anthracene, dihydroanthracene, and phenazine were selected from the other stabilizers for more detailed study. Continued study of several of the most promising petroleum and coal tar stocks as coolants showed that initial content of high boiling material is not detrimental to radiation stability, and results on fractions with and without such initial "high boiler" content can be directly compared. High temperature stability continues to be a problem. Cobalt molybdate on low surface area alumina continued to give good results in hydrocracking to reclaim coolant. Good results with other catalysts including an active nickel preparation were found also. Longer runs with the best catalysts confirmed the desirability of long process cycle, low conversion runs with recycle. Detailed chemical studies of the reclaimed material were made. Linac irradiations of the reclaimed material showed low formation of polymer compared to Santowax but rather high gas formation. (auth)

25019 (IDO-16761(p.75-97)) EOCR EXPERIMENTAL PROJECTS. R. S. Kern, L. L. Porter, et al. (Phillips Petroleum Co. Research Div., Bartlesville, Okla.).

In connection with EOCR construction, technical activities include engineering liaison on two loops and establishing design criteria for a third loop. Tests to determine how control rod latch mechanism behaves under abnormally adverse conditions were completed. (auth)

25020 (IDO-16761(p.98-105)) EOCR OPERATIONS. (Phillips Petroleum Co. Research Div., Bartlesville, Okla.).

Review and evaluation of various EOCR design and construction problems which might affect the operation on safety of the facility were studied. Additional field test procedures were written. Acceptance testing was performed on the EOCR instrumentation. Further investigations and studies were made of the plant radiation levels expected with the reactor operating at 40 Mw under normal and abnormal conditions. Testing of an EOCR prototype control rod and drive mechanism was continued. The testing revealed the need of some modifications to the rod. (auth)

25021 (IDO-19308) SOME ASPECTS OF THE WTR AND SL-1 ACCIDENTS. A. Nelson Tardiff (Division of Reactor Development, AEC). Apr. 9, 1962. 90p.

For presentation at International Atomic Energy Agency Symposium on Reactor Safety, Vienna, Austria, May 14-18, 1962.

The Westinghouse Testing Reactor (WTR), a privately owned 60 megawatt tank type reactor, underwent a fuel element failure on April 3, 1960. A meltdown of one fuel element occurred causing the spread of fission products through the reactor cooling system. There were no casualties or overexposures. The cause of the accident could not be established beyond a reasonable doubt, but the possible cause appeared to be a cladding failure at a bonding defect. The Stationary Low Power Reactor No. 1 (SL-1), a 3 megawatt prototype reactor, underwent a nuclear excursion at the U. S. Atomic Energy Commission's National Reactor Testing Station (NRTS), Idaho, on January 3, 1961. The three military operators on duty at the time received fatal injuries and the core experienced severe damage. Large amounts of radioactivity were released inside the reactor building; however, release of radioactivity from the building to the atmosphere was slight. This was the first fatal reactor accident in the history of reactor operation in the United States. Prior to the accident, the reactor had operated for 931 megawatt days, approximately 40% of its core life. Primary efforts subsequent to the SL-1 accident consisted of removal of the victims from the reactor building, determination of the nuclear status of the reactor, and analysis of the cause of the accident, including dismantling of the facility. Since the cause of the SL-1 accident was not known, work on the dismantling and decontamination of the reactor building had to proceed slowly lest some important evidence might be overlooked. The high radiation levels inside the reactor building also played an important part in slowing up the recovery operations. By the end of November 1961, the pressure vessel with the SL-1 core had been removed from the reactor building and transported 40 miles to a large hot cell on the testing station previously used to disassemble large experimental reactors. In the hot cell more detailed examination of the disarranged core proceeded. (auth)

25022 (JAERI-1025) CRITICAL EXPERIMENTS AND CHARACTERISTICS MEASUREMENT FOR JRR-2. (Japan Atomic Energy Research Inst., Tokyo). Dec. 1961. 62p. (In Japanese)

JRR-2, the second research reactor, is a thermal reactor, using the MTR-type fuel of 20% enriched U, with heavy water both as moderator and coolant. The maximum thermal output and the mean thermal flux of the reactor are 10 Mw and 1×10^{14} n/cm^2/sec. The results of the various characteristic measurements on the reactor performed during a 4-month period after criticality was reached are presented. Included are results of critical experiments, calibration of control rods, reflecting effect of the upper part of heavy water, reactivity effect of fuel elements, characteristic measurement of the temperature coefficient, measurement of the distribution of the thermal fluxes, and calibration of the power output. (auth)

25023 (ORNL-3282) MOLTEN-SALT REACTOR PROGRAM. Semiannual Progress Report for Period Ending February 28, 1962. (Oak Ridge National Lab., Tenn.). July 11, 1962. Contract W-7405-Eng-26. 138p.

Progress is reported on the development of the Molten Salt Reactor Experiment. Topics covered include design, component development, reactor engineering analysis, metallurgy, in-pile tests, chemistry, and fuel processing. (M.C.G.)

25024 (TID-14881) PRELIMINARY HAZARDS SUMMARY REPORT FOR AMES LABORATORY RESEARCH REACTOR, AMES, IOWA. (AMF Atomics. Div. of American Machine and Foundary Co., Greenwich, Conn.). May 1960. Contract AT(11-1)-855. 287p.

The design and safeguards of the Ames Laboratory Research Reactor and its associated facilities are reviewed. The causes and consequences of serious accidents are

considered. It was found that the maximum credible accident for the ALRR is a quite melt-down of the aluminum core, which results from loss of D_2O coolant. The accident is assumed to release 60% of the noble gases, 25% of the halogens, and 1% of the particulate fission products stored in the core. Downwind doses to persons outside the exclusion area are calculated on the basis of the above fission product release and the attenuation of activity provided by the containment system. Extreme inversion, fumigation, and rainfall conditions are assumed. The restrictive effect of strontium fallout on surrounding agriculture is considered. It was found that the maximum credible accident, in combination with the specified containment and exclusion criteria, does not endanger the health and safety of persons outside the exclusion area, and does not impose restrictions upon agriculture. (auth)

25025 (TID-15977) NEUTRON FLUX AND ENERGY SPECTRUM MEASUREMENTS IN THE K. U. TRAINING REACTOR USING THRESHOLD FOILS (thesis). Dennis R. Johnson (Kansas. Univ., Lawrence). May 1962. 62p.

The magnitude and energy distribution of neutron fluxes in the Kansas University Reactor were investigated. Gold and cadmium-covered gold foils were employed to determine the thermal neutron flux distribution throughout the reactor core. From these measurements, the core power was calculated to be 1.29 watts for a nominal setting of 3.0 watts. Plutonium, uranium, and sulfur threshold detectors were used in addition to bare and cadmium-covered gold foils to investigate the neutron energy spectrum in the pneumatic tube facility. The results are as follows: the thermal flux is 6.45×10^6 n/cm^2-sec-watt; the fast fluxes above 1 kev, 1.45, 2.9, and 6.1 Mev are 5.83×10^5, 1.17×10^6, 3.67×10^5, and 1.36×10^5 n/cm^2-sec-watt respectively. From these data a neutron energy spectrum was prepared and the first collision neutron dose rate was calculated to be 33.8 rads/hr-watt. (auth)

25026 SHIELDING CALCULATIONS FOR DAPHNE REACTOR. [PART] I. G. Constantine and K. R. E. Smith (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Chem. & Process Eng., 43: 286-8(June 1962).

DAPHNE is an enriched-U-fueled, heavy-water-moderated and -reflected reactor with a maximum design power of 100 w. It has radial shielding consisting of 2 ft × 2 ft × 6 ft Portland cement blocks in a staggered double layer. The doses from fast neutrons, core gamma rays, and capture gamma rays outside the radial shielding are calculated to be 0.3, 2.4, and 2.9 mr/hr, respectively. (T.F.H.)

25027 MEASUREMENTS OF THERMAL AND FAST NEUTRON FLUX IN THE EWA (EVA) REACTOR. Witold Lada and Zenon Tomczak (Inst. of Nuclear Research, Warsaw). Nukleonika, 7: 43-6(1962). (In Polish)

Neutron flux measurements were made along the vertical axes of seven ports of access to the EWA reactor. These included isotopic ports and ports in the thermal column. The thermal and epithermal fluxes were measured with gold and cobalt wires, using coincidence techniques to minimize background counts and unwanted radiations from the wires. The fast flux measurements were made with the use of the $Al^{27}(n,\alpha)Na^{24}$ and $S^{32}(n,p)P^{32}$ reactions, both serving as threshold detectors. In one of the isotopic ports, the thermal flux measurement yielded a flux of 1.9×10^{13} with gold activation and 1.8×10^{13} with cobalt activation. The epithermal flux measurement with gold activation gave the value of 1.6×10^{11}, and 3.0×10^{11} with cobalt activation. The fast flux above Al^{27} threshold was measured as 6.5×10^{10}, and 6.1×10^{11} above S^{32} threshold. (TTT)

25028 LIGHT WATER MODERATED NUCLEAR RESEARCH REACTOR. Ernest Loeb (to Allis-Chalmers Mfg. Co.). U. S. Patent 3,042,601. July 3, 1962.

A swimming pool-type reactor is designed with the pool divided into a stall station and a bulk shield station and with a tank station below the stall station. Both stall and tank stations are provided with experimental facilities, and the core is movable to either station for irradiation experiments. Means is also provided for circulating cooling water through the core in either station. (D.L.C.)

SPACE APPLICATIONS AND TECHNOLOGY

Refer also to abstracts 24594 and 24595.

25029 (AD-269180) SOLAR THERMOELECTRIC GENERATORS FOR APPLICATION OUTSIDE THE EARTH'S ATMOSPHERE. PHASE I. (Curtiss-Wright Corp. Solar Lab., Princeton, N. J.). Contract DA-44-177-TC-622. 71p. (TCREC-TR-61-77)

Results are presented of a basic research project in two phases to determine feasibility of solar thermoelectric generators outside of the earth's atmosphere. It was concluded that simultaneous solutions of two problems are required. Solar energy collection and heat sink radiation efficiency must be as high as possible to obtain the widest possible temperature difference between the hot and cold junctions of the thermoelectric generator. Using selective absorbing and radiating surfaces on flat-plate collectors, and 10- to 20-fold concentrating collectors, a temperature difference of 200 to 520°C can be reached with a collection efficiency in excess of 50%. Thermoelectric efficiency with materials presently available can reach 9% efficiency with a factor of merit Z = 0.002 per C. With Z = 0.004, an efficiency of 19% could be attained at 500°C temperature difference. Flat-plate and oriented concentrating collectors are also discussed. (auth)

25030 (AFOSR-1632) ELECTRIC PROPULSION RESEARCH. Oscar A. Berthold and Milton M. Slawsky (Air Force Office of Scientific Research, Washington, D. C.). May 8, 1961. 38p. (AD-264767)

A survey and analysis is presented of the research efforts on electric propulsion. The list of research efforts is separated into two major groups based on the degree of relevance to the electric propulsion program. Group one includes those efforts which directly contribute to the electric propulsion work as such. Group two comprises the balance of the selected research efforts which contribute somewhat less directly to elastic propulsion, but which are still positively related to it. (auth)

25031 (JPL-TR-32-232) TEMPERATURE-CONTROL ENGINEERING OF A NUCLEAR-ELECTRIC SPACECRAFT. J. J. Volkoff (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). May 15, 1962. Contract NAS 7-100. 21p.

A study is presented of the significance of temperature in the design of spacecraft components and its effect on the over-all performance and operational range of a nuclear-electric ion-propelled spacecraft. A conceptual 70-kwe spacecraft configuration for an Earth-to-Venus deep-space mission is selected for this study. Expected operating steady-state temperatures of the spacecraft subsystems are examined. Environmental factors including solar, nuclear, and planetary thermal energies are shown to have considerable effect on component or system temperature. Spacecraft subsystems and components are briefly discussed with regard to system requirements, specifications, and configuration. The expected temperature gradients and proposed methods for temperature control are surveyed. Major temperature-control problems of spacecraft subsystems and their interrelated effects are discussed. Suggested methods to lessen the environmental and interrelated effects and to prevent a component from approaching a critical operating condition are discussed. (auth)

25032 (NP-11619) ASTRONAUTICS INFORMATION. ABSTRACTS, VOL. V, NO. 4. Abstracts 5,331-5,455. B. J. Hardgrove and F. L. Warren, comps. (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). Apr. 1962. Contract NAS 7-100. 134p.

Abstracts on astronautics information are presented. The 124 abstracts cover the period of April 1962. Author, subject, and source indexes are included. (M.C.G.)

WASTE DISPOSAL AND PROCESSING

Refer also to abstract 23637.

25033 (AAEC/TM138) LABORATORY TESTS OF THE USE OF VICTORIAN BROWN COAL FOR REMOVING TRACES OF RADIOACTIVITY FROM WATER. J. O'Keefe (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). May 1962. 8p.

Measurements were made of the capacity of pre-treated Victorian brown coal for removing trace quantities of Sr^{2+} and Cs^{+} at pH 8.0 and 9.5 in the presence of various concentrations of Ca^{2+}. At 20 ppm Ca^{2+} breakthrough was immediate. (auth)

25034 (CEA-2147) LE TRAITEMENT ET LE CONDITIONNEMENT DES DECHETS RADIOACTIFS SOLIDES. (The Treatment and Conditioning of Solid Radioactive Waste). P. Cerre and E. Mestre (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). 1962. 21p.

Previous studies, the results of which were confirmed by experiments, have led us to build a semi-industrial plant for the treatment and coating of solid radioactive waste. The pilot plant using these treatment methods is described along with the treatment operations. (auth)

25035 (HW-69225) MINERAL ADSORPTION OF RADIONUCLIDES IN REACTOR EFFLUENT. D. W. Bensen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 6, 1961. Contract AT(45-1)-1350. 5p.

The relative adsorption of P^{32}, As^{76}, Np^{239}, Zn^{65}, and Cr^{51} from tap water was determined by contacting radionuclide solutions with finely ground samples of 25 selected minerals. P^{32} was adsorbed best by olivine, pyrite, pyrrhotite, fluorite, calcite, galena, dolomite, hornblende, scapolite, goethite, microcline, apatite, and epidote. Moreover, olivine and pyrrhotite exhibited good adsorption of arsenic, zinc, and chromium. Neptunium adsorption was not significant with any of the minerals. (auth)

25036 (ORNL-TM-260) HEAD-END TREATMENT OF LOW LEVEL WASTES PRIOR TO FOAM SEPARATION. Ernest Schonfeld and W. Davis, Jr. (Oak Ridge National Lab., Tenn.). May 29, 1962. Contract [W-7405-Eng-26]. 11p.

Calcium-magnesium precipitation apparatus was used to reduce the concentrations of these elements in ORNL tap water, used as a substitute for waste water of low level of radioactivity, prior to strontium removal by foam separation. With and without alkali and flocculator chambers and with a stirred sludge of ratio height to diameter equal to 1/1 to ~4/1, use of 5×10^{-3} M each of NaOH and Na_2CO_3 and 2 ppm Fe^{3+} reduced the dissolved Ca + Mg concentrations to 1 to 2 ppm as calcium. Simultaneously, a strontium DF of 20 to 200 was achieved, and, by adding Grundite clay in the proportion ~0.5 lb/1000 gal, a cesium DF of 10 to 40 was achieved. (auth)

25037 (TID-7628) SECOND CONFERENCE [ON] GROUND DISPOSAL OF RADIOACTIVE WASTES HELD AT ATOMIC ENERGY OF CANADA LTD, CHALK RIVER, CANADA, SEPTEMBER 26–29, 1961. James M. Morgan, Jr., Donald K. Jamison, and John D. Stevenson, comps. and eds. (Johns Hopkins Univ., Baltimore). Mar. 1962. Contract AT(30-1)-1477. 644p.

A conference on the Ground Disposal of Radioactive Wastes was held at Chalk River, Canada, in September 1961. Technical aspects of the ground disposal of various types of radioactive wastes in the United States and other countries were discussed. Separate abstracts have been prepared on 41 papers presented at this meeting. Two papers were previously abstracted in NSA. (C.H.)

25038 (TID-7628(p.3-9)) AECL DISPOSAL FACILITIES. C. A. Mawson (Atomic Energy of Canada Ltd., Chalk River, Ont.).

Waste disposal facilities at the Chalk River plant of Atomic Energy of Canada Limited are described and illustrated. (C.H.)

25039 (TID-7628(p.9-12)) MONITORING OF NEPHELINE SYENITE GLASS DISPOSALS AND SOIL MONITORING. W. F. Merrett (Atomic Energy of Canada Ltd., Chalk River, Ont.).

Monitoring procedures are described for measuring the radioactivity leaving blocks of nepheline syenite glass in which high level wastes from a fuel processing facility were incorporated. Measurements were also made on soil samples in the vicinity of the blocks. (C.H.)

25040 (TID-7628(p.12-16)) NEW DEVELOPMENTS IN THE USAEC GROUND DISPOSAL PROGRAM 1959-1961. Walter G. Belter (Atomic Energy Commission, Washington, D. C.).

Investigations were made of the possibility of ground waste disposal in salt domes or beds, deep permeable formations, and excavations in impermeable formations. Preliminary results are reported from geochemical and geophysical studies. (C.H.)

25041 (TID-7628(p.67-76)) GRAPHIC EVALUATION OF HYDROLOGIC FACTORS IN MANAGEMENT OF RADIOACTIVE WASTES. Harry E. LeGrand (Geological Survey, Washington, D. C.).

Favorable geologic and hydrologic conditions for handling radioactive wastes are those that prevent hazardous amounts of radioactivity from entering the present or future water and mineral supplies and from entering populated parts of the biosphere. The tendency of certain earth materials to absorb and retain radioactive ions in relation to the opposing tendency of ions to move and disperse in naturally occurring water are discussed. Hydrologic factors affecting the retention potential of various soils for wastes are reviewed. (C.H.)

25042 (TID-7628(p.77-98)) THE MEASUREMENT OF HANFORD'S GEOHYDROLOGIC FEATURES AFFECTING WASTE DISPOSAL. Randall E. Brown and John E. Raymond (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). (HW-SA-2260)

Movement of radioisotopes in the ground is almost wholly through ground waters. Understanding of the principles of ground water movement is thus necessary if safe storage locations are selected and effective surveillance is achieved. Five basic ground-water concepts that are important in waste disposal include the vertical component of ground-water movement, quantitative dispersion of ground-water contaminants, the effect of aquifer anisotropism, the range of ground-water flow rates within the average rate usually calculated, and the hydrologic continuity between well and aquifer. Ground waters rarely can be observed directly. Methods are described that are used at the Hanford Atomic Products Operation for the measurement of geohydrologic features affecting waste disposal. (C.H.)

25043 (TID-7628(p.99-114)) GEOPHYSICAL RESEARCH AT THE NATIONAL REACTOR TESTING STATION. Paul H. Jones (Geological Survey, Idaho Falls, Idaho).

Both surface reconnaissance and borehole geophysical methods are described that have been used in geologic and hydrologic investigations in the eastern Snake River Plain, in which the National Reactor Testing Station is located. Airborne magnetometer and scintillometer surveys and gravity surveys were also made. Six logging methods are described that have yielded information necessary for quantitative study of waste disposal hydrology. These methods include electric, gamma ray, hole-diameter, flow-meter, temperature, and water resistivity logging. The equipment used consisted of a WIDCO logger with multi-conductor steel cable on a power driven reel. A magnetometer was developed to detect differences in mineral content between basalt flows. The borehole-geophysical-logging methods described were used for hydraulic and tracer studies employing a network of wells that top a single aquifer. The data formed a basis for waste disposal hydrology at the National Reactor Testing Station. (C.H.)

25044 (TID-7628(p.115-29)) DISPOSAL OF RADIOACTIVE WASTES TO THE GROUND AT THE SAVANNAH RIVER PLANT. S. O. Reichert (Du Pont de Nemours (E. I.) Co. Savannah River Plant, Aiken, S. C.).

Results are presented from geological and hydrological studies in the area of the Savannah River Plant. The hydrologic, geologic, climatic, and demographic characteristics of the region do not encourage the disposal of radioactivity to the environment except under the most conservative conditions. Therefore, total containment of radioactive waste is the basic principle of operation. Waste management practices are described. (C.H.)

25045 (TID-7628(p.130-44)) HANFORD STUDIES ON FLOW IN POROUS MEDIA. R. W. Nelson and A. E. Reisenauer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). (HW-SA-2251)

Methods are described for use in studies on the behavior of ground water in both homogeneous and heterogeneous soils. Basic equations are presented for use in hydrodynamic descriptions. A computer program is described for use in solving problems of unsaturated flow, saturated flow problems with either heterogeneous or homogeneous soils, and problems involving combined partially-saturated and saturated flow. Typical applications are included. (C.H.)

25046 (TID-7628(p.155-65)) INVESTIGATIONS ON THE MOVEMENT OF RADIOACTIVE SUBSTANCES IN THE GROUND. PART II. THE COPPER-ROD METHOD FOR MEASURING GROUND-WATER FLOW. J. Souffriau, R. Simpson, L. Baetsle, and P. Dejonghe (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). (EURAEC-184 (Pt.II))

Preliminary tests showed the possibility of measuring the ground-water flow using a chemisorption reaction on silver-plated copper rods after injecting I^{131} as a ground-water tracer. Laboratory tests with the I^{131}-copper-rod system indicated that a reproducible relation exists between the activity in solution and that fixed on the metallic surface (copper, silver-plated copper, or mercury-coated copper). Two preliminary field tests are described in which silver-plated copper rings were fixed on a steel bar and inserted in the ground after injection of respectively 1 mc I^{131} in test n°1 and 5 mc I^{131} in test n°2. In both tests, the I^{131} solutions were introduced after freezing. Results indicate the copper-rod method is convenient for detailed measurement of the ground-water flow paths and dispersion in shallow aquifers. However, some technical aspects of the method have to be elaborated further with regard to mechanical strength of the rods and possible vertical movement of the injected source. Furthermore it is envisaged to extend the use of the method by studying other tracing systems which could react with a metallic surface. Presently the possibility of using a tracer such as $Co(CN)_6^{4-}$ is under consideration. (auth)

25047 (TID-7628(p.166-78)) NOTES ON DISPERSION IN FLUID FLOW BY GEOLOGIC FEATURES. C. V. Theis (Geological Survey, Albuquerque, N. Mex.).

Geologic features that affect both longitudinal and lateral dispersion during the flow of fluids through a porus medium, such as soils, are discussed. The effects of sedimentary structures and other non-homogeneities found in nearly all geologic formations are considered. It is pointed out that presence in an aquifer of materials of variable permeabilities produces a wide range of velocities in essentially horizontal flow and inhibits vertical flow and the movement of water between different horizons in an aquifer. Results are included from two tracer studies, one using uranine dye and the other tritium as tracer, of ground water dispersion in dissimilar geologic formations. (C.H.)

25048 (TID-7628(p.179-86)) PROBLEMS IN SORPTION ON CLAY MINERALS ILLUSTRATED WITH DATA ON THE SYSTEM Ca–Ba–MONTMORILLONITE. Henry C. Thomas (North Carolina. Univ., Chapel Hill).

Problems encountered in studies on the sorption of radionuclides on soil minerals are discussed. Tentative results are included from investigations on the characteristics of the exchange sorption of Ca-Ba on heated montmorillonite clay. Data are tabulated. (C.H.)

25049 (TID-7628(p.187-97)) STRONTIUM REACTIONS WITH MINERALS. T. Tamura (Oak Ridge National Lab., Tenn.).

Results are reported from slurry tests of the reactions of Sr^{85} in simulated waste solutions with various absorbent minerals. Mechanisms investigated included ion as an absorption process exemplified by the resins, clinoptilolite, and the clay minerals; ion exchange as an adsorption process characterized by the reaction of alumina; metasomatic replacement as characterized by the $CaCO_3$-phosphate reaction; and precipitation reactions as evidenced by natural vermiculites and clinoptilolite in contact with phosphated waste. Data are tabulated. (C.H.)

25050 (TID-7628(p.198-210)) INVESTIGATIONS ON THE MOVEMENT OF RADIOACTIVE SUBSTANCES IN THE GROUND. PART III. PRACTICAL ASPECTS OF THE PROGRAM AND PHYSICOCHEMICAL CONSIDERATIONS. L. Baetslé and P. Dejonghe (Mol, Belgium. Centre d'Etude de l'Energie Nucléaire). (EURAEC-184(Pt.III))

The physiochemical characteristics of numerous samples of soil from the Mol site were determined. Distribution coefficients were determined in equilibrium conditions for the radioelements Sr, Cs, and Eu in different chemical media such as demineralized water, HNO_3, tapwater, and groundwater. An attempt was made to calculate approximately the volume of active solution that may percolate through the soil layers before the radionuclides reach the groundwater. The dynamic conditions of the ion exchange phenomena and the degree of water saturation of the profile were taken into account. An insolubilization method was tested using petroleum tar as a protective agent. (C.H.)

25051 (TID-7628(p.211-13)) EFFECT OF COLUMN LENGTH ON THE Sr-90 REMOVAL BY A CALCITE-PHOSPHATE COLUMN. T. Belot and C. Gailledreau

(France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay).

Results are reported from studies on the effect of column length on Sr^{89} removal from solutions by a calcite-phosphate column. Reaction mechanisms are discussed. (C.H.)

25052 (TID-7628(p.214-36)) HANFORD STUDIES IN GEOCHEMISTRY. J. L. Nelson, D. W. Bensen, and K. C. Knoll (General Electric Co., Hanford Atomic Products Operation, Richland, Wash.). (HW-SA-2273)

In 1957, a research program was initiated at Hanford to quantitatively define the variables that effect the retention of radionuclides by soils. Chromatographic equations from the literature were applied to soil column breakthrough data, thus permitting a prediction of breakthrough of radionuclides from ground disposal facilities. A study was made of the effects of temperature, species of accompanying ion, concentration of accompanying ion, concentration of trace ion, pH, column diameter, column length, and flow rate on strontium breakthrough curves. Although initial attempts to fit the column length data to chromatographic equations were not successful, some adjustment methods were found which bring the equations into better agreement with laboratory results. The adjustments also tended to provide an improved understanding of the mechanisms involved. In addition to these findings, the results of research on the reactions of rare earths with soils, a study of the effect of hydrodynamic unsaturation on ion exchange, further results from a model crib, and a brief description of the mineral reactions studied at Hanford are presented. (C.H.)

25053 (TID-7628(p.237-47)) GEOCHEMICAL STUDIES PERTAINING TO GROUND STUDIES OF RADIOACTIVE WASTES. C. R. Naeser (Geological Survey, Washington, D. C.).

Results are reported from geochemical studies pertaining to waste disposal. Both empirical and fundamental approaches to the problem were considered. The behavior of vermiculite, glauconite, crandallite, and anhydrite as scavengers for radio-cesium and/or radio-strontium and the effectiveness of the scavenging process as a function of the pH were investigated. (C.H.)

25054 (TID-7628(p.248-81)) MOVEMENT OF PLUTONIUM THROUGH LOS ALAMOS TUFF. C. W. Christenson and R. G. Thomas (Los Alamos Scientific Lab., N. Mex.).

Early work at Los Alamos under the Manhattan Project was geared for speed. Liquid radioactive wastes from the plutonium processing plant were allowed to percolate through seepage pits constructed in the porous tuff. Data are presented from a series of studies on the movement of Pu through the tuff. Under field conditions, Pu species were shown to penetrate at least 28 ft in Los Alamos tuff. Data indicate the dangers associated with the practice of uncontrolled and uncontained ground disposal of radioactive waste. (C.H.)

25055 (TID-7628(p.303-23)) STUDIES OF INJECTION DISPOSAL. Yoriteru Ionue and Warren J. Kaufman (California. Univ., Berkeley).

A theory for the prediction of radioisotope transport through porous media is presented that is applicable to complex flow systems such as may be encountered in the injection of radioactive wastes into deep sandstone formations. The application of the theory requires that the distribution of solvent residence times in the region of interest be ascertained by a suitable tracer test. If certain conditions prevail and if it is possible to obtain sufficiently accurate measures of the formation porosity and ion exchange properties, the radioisotope breakthrough curve may be computed by a simple transformation of the solvent breakthrough curve. Laboratory column studies and a two-well field test were completed and are considered to support the theory. A five-spot arrangement of injection and relief wells is under study and is expected to provide further substantiation. The inherent weakness of the method stems from the difficulty in determining the formation porosity and from the problem of characterizing a relatively nonhomogeneous natural creation by an inconsequentially small sample. The field studies described herein were conducted on a water-deposited sand and gravel-confined aquifer of demonstrated nonhomogeneous character. It is felt that the extensive, deep sandstone formations considered suitable for waste injection will exhibit a greater homogeneity and will also permit more precise predictions of radiocontaminant transport. (auth)

25056 (TID-7628(p.324-46)) RESEARCH ON FIELD PROBLEMS ON INJECTING SOLUTIONS INTO PERMEABLE ROCKS. Jerry B. F. Champlin (Bureau of Mines, Bartlesville Petroleum Research Center, Okla.).

The continued development of the nuclear industry in the United States requires a program of waste disposal that insures against the release of large amounts of radioactivity to the environment. Results are described from research on one proposed means of disposal of this waste, that of injection into geologic formations at depth. Nuclear production plant wastes were simulated and injected into samples of sedimentary rock obtained from outcrops, quarries, and deep wells. Changes in the chemi-physical characteristics of the rocks caused by the interaction of ions and suspended particles in the waste solutions with the cementing material and clay-like particles in the rock are discussed. Laboratory tests show that injectivity can be maintained over a longer period of waste injection by monitoring the ionic balance and particle size distribution of the waste stream. (auth)

25057 (TID-7628(p.347-55)) GEOLOGIC BASIN STUDIES AS RELATED TO DEEP-WELL DISPOSAL. John E. Galley (American Assn. of Petroleum Geologists, Tulsa, Okla.).

Developments are reported in an investigation of sites for the disposal of radioactive wastes in deep wells. Results are summarized from a preliminary survey on the geology of the Appalachian, Michigan, Salina, Denver, and San Juan Basins. (C.H.)

25058 (TID-7628(p.356-62)) DEEP WELL DISPOSAL OF URANIUM TAILING WATER. Z. E. Arlin (Anaconda Co., Grants, N. Mex.).

A deep-well injection system for the disposal of uranium mill tailing water has been in operation since 1960. The facility is described. Data are tabulated on the chemical and radioactive constituents of the waste water injected in the disposal well. The monitoring system is described and the behavior of the injected waste water is discussed. (C.H.)

25059 (TID-7628(p.363-73)) DEEP WELL FLUID WASTE DISPOSAL. E. G. Halligan (Chemical Corps, Army Chemical Center, Md.).

The construction of two deep well fluid chemical waste disposal facilities is described. The treatment of fluids and wells, operating procedures, and cost factors are discussed. (C.H.)

25060 (TID-7628(p.374-9)) THE USES OF WATER INJECTION TO THE SUB-SURFACE THROUGH BOREHOLES. E. V. O'Rourke (Ohio State Univ., Columbus).

The use of water injection to the sub-surface through boreholes for the disposal of salt water produced by oil

wells and the use of sedimentary rocks for the storage of natural gas are discussed. The possibility of using old oil and gas fields for the disposal of radioactive wastes is considered. (C.H.)

25061 (TID-7628(p.380-95)) STUDIES OF THE CONTAINMENT OF RADIOACTIVE WASTES IN UNDERGROUND MINED CAVERNS AT THE SAVANNAH RIVER PLANT. W. E. Prout (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.).

The du Pont Company is coordinating an exploratory drilling program to determine the feasibility of mining caverns for the storage of radioactive wastes in the basement rock underlying the Savannah River Plant. Other groups participating in the study include the U. S. Corps of Engineers and the U. S. Geological Survey. The results obtained from tests made in conjunction with the first deep rock boring reinforce the initial indication that the geology of the basement rock is favorable for storage of radioactive wastes. From the results of the chemical and physical tests of the rock core, and from packer tests made in the boring, the quality of the 500-foot section of rock below about 400 feet is favorable for waste storage. The physical tests, such as unconfined compressive strength, show that the rock is adequate to preclude any unusual design restrictions on the size and shape of storage caverns. The less-than-average unconfined compressive strength values (below 16,000 psi) of some of the core samples do not necessarily affect the design and stability of underground openings. (auth)

25062 (TID-7628(p.396-427)) LAND BURIAL OF SOLID PACKAGED LOW HAZARD POTENTIAL RADIOACTIVE WASTES IN THE UNITED STATES. J. M. Morgan, Jr., John C. Geyer, J. D. Stevenson, D. K. Jamison (Johns Hopkins Univ., Baltimore), and D. C. Costello (Atomic Energy Commission, Washington, D. C.).

More than 7,000,000 cubic feet of low hazard potential solid radioactive waste from the 15-year old nuclear energy industry have been buried in the continental United States in shallow trenches at government-controlled Atomic Energy Commission installations. Throughout the atomic industry today, there are over four thousand establishments, ranging in size from the largest Commission production sites through modest commercial and industrial isotope users to small hospital and university research laboratories, performing operations that result in the generation of increasingly large amounts of solid radioactive materials that must be painstakingly handled, safely packaged, and often transported long distances. The wastes are characterized by a wide variety of chemical content and toxic types, and generally by low concentrations of activity. The management and disposal of this large volume of useless material, of varying activity, from the nation-wide nuclear energy and radioisotope program are described. The problems vary widely depending upon the nature, concentration, and quantity of radioactivity involved, and on the specific environment in which the material will ultimately repose. Safety factors and hazards must be carefully considered at each step in the disposal system which involves packaging, shipping, handling, monitoring, and burial. (auth)

25063 (TID-7628(p.428-36)) CONSIDERATIONS FOR SELECTION AND OPERATION OF RADIOACTIVE WASTE BURIAL SITES. A. E. Peckham (Geological Survey, Washington, D. C.) and Walter G. Belter (Atomic Energy Commission, Washington, D. C.).

The feasibility is discussed of establishing and safely operating a disposal facility for low-hazard potential solid radioactive wastes. Factors to be considered in site selection and operation are considered. (C.H.)

25064 (TID-7628(p.437-59)) LAND BURIAL OF SOLID WASTE AT OAK RIDGE NATIONAL LABORATORY. T. F. Lomenick and K. E. Cowser (Oak Ridge National Lab., Tenn.).

The geological and hydrological conditions that exist at Burial Ground 4, now abandoned, are described, and findings with respect to surface- and ground-water contamination at the site are reported. The site was opened in February 1951 and closed to routine burial operations in July 1959. The average rate of burial during this period was about 2.5 acres per year. Approximately 50% of the buried waste at the site originated at Oak Ridge National Laboratory, while the remainder was contributed by more than 50 off-site agencies. The burial ground is underlain by the Conasauga shale of Cambrian age. At the site the formation consists mostly of maroon and gray shales interbedded with a few thin limestone lenses. Water-level measurements indicate that the buried waste is in contact with ground water during most periods of the year. Activity was detected in water samples from a number of wells located in areas of low topography where ground-water contact with the waste is greatest. Radionuclides were also found in seeps and streams within the area. Identifiable contaminants include Ru-106, Co-60, Cs-137, Sr-90, Zr-Nb-95, Po-210, Pu-239-240, and the trivalent rare earths. The contribution of activity from the burial ground to nearby White Oak Creek has been insignificant. The criteria employed in selecting Burial Ground 5, the methods used in evaluating the site, and a preliminary analysis of a new burial trench design are discussed. Forty-five auger wells were drilled to determine the character of the residual cover, the depth of the water table, and the chemical and radionuclide composition of the ground water. Five deep wells were drilled to define the occurrence and circulation of ground water at greater depth. Pressure tests of the deep wells showed that the most permeable zones or fractures occur within the first 100 ft of depth below ground surface. The new burial trench, including a gravel underdrain, collecting sump, observation well, and asphalt cap, was designed to improve monitoring and restrict groundwater and surface-water contact of the waste. (auth)

25065 (TID-7628(p.460-1)) NORTHEASTERN BURIAL GROUND STUDIES. R. M. Richardson (Oak Ridge National Lab., Tenn.).

A preliminary survey was made of about 15 sites in New York, Ohio, and Indiana for possible use as burial grounds for solid, packaged, radioactive waste. Geographic factors, geologic factors, population density and distribution, water use down gradient from the site, and volume of flow of receiving streams to provide dilution were considered. It was concluded that those sites drained by short, undeveloped tributaries of Lake Erie and Lake Ontario are the most suitable for the intended use. (C.H.)

25066 (TID-7628(p.462-8)) IMPROVED BURIAL OF SOLID RADIOACTIVE WASTES. R. H. Hawkins (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.).

An evaluation was made of materials that will prevent leaching of buried solid radioactive wastes. A number of materials were considered on the basis of low moisture permeability and long life in the soil. Bentonite, in a sodium-saturated form from commercial deposits in Wyoming, gave best results on preliminary tests. Results are reported from tests conducted to provide further per-

meability information and to gain experience in the actual application of bentonite on a large scale. (C.H.)

25067 (TID-7628(p.469-76)) STORAGE OF LOW-LEVEL PACKAGED SOLIDS IN A SALT MINE. F. M. Empson (Oak Ridge National Lab., Tenn.).

Mined-out space in salt mines presents many desirable characteristics for the disposal of low-level packaged radioactive wastes. Large volumes of clean, dry space are available at depths greater than 500 feet below the surface of the earth. The space is almost completely isolated from the environment with access only through hoisting and ventilating shafts. Due to the plasticity and impermeability of salt, material placed in such an opening would be secure for geologic time if the shaft were adequately plugged at the completion of the operation. Limiting factors in salt mine disposal and modifications required to permit disposal of low-hazard potential solid waste are discussed. A map shows the occurrences of salt mines in the United States. (C.H.)

25068 (TID-7628(p.477-90)) STORAGE OF HIGH-LEVEL PACKAGED SOLID WASTES IN ROCK SALT. R. L. Bradshaw, W. J. Boegly, Jr., F. M. Empson, H. Kubota, and E. G. Struxness (Oak Ridge National Lab., Tenn.).

Storage of high-level packaged solid radioactive wastes in natural salt formations was investigated. It was concluded that the problem of predicting temperature rises in salt formations is essentially solved but the effects of radiation, heat, and pressure on the structural stability of mined openings should be investigated more thoroughly. (C.H.)

25069 (TID-7628(p.491-505)) A COMPARISON OF GROUND WASTE DISPOSAL STATUS AT HANFORD, 1959-1961. E. R. Irish (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). (HW-SA-2236)

The status of ground disposal of radioactive wastes at Hanford is summarized. Emphasis is placed on the period from July 1959 through June 1961. Data are tabulated on the volumes of wastes discharged to cribs and trenches and the annual and accumulated fission product curies. The activity in the ground after decay was calculated. It was concluded that the discharge of large volumes of low- and intermediate-level wastes to the ground at Hanford has been done safely, and it is planned to continue ground disposal in the future. (C.H.)

25070 (TID-7628(p.506-12)) GROUND DISPOSAL OF LIQUID WASTES AT OAK RIDGE NATIONAL LABORATORY. E. J. Witkowski and J. F. Manneschmidt (Oak Ridge National Lab., Tenn.). (ORNL-TM-142)

After ten years of shallow ground disposal of liquid wastes at ORNL, confidence in the long-term safety of the operation has been shaken. All the tests that have been made thus far have not satisfactorily ruled out the very remote long-range possibility of serious Clinch River contamination. This fact, plus the public-relations problems that could be created by continued releases of Ru^{106}, even though these releases may be below tolerance levels, could have a detrimental effect on the long-term operation of the Laboratory. The Laboratory management has therefore concluded that it would serve the best interest of both the public and the Laboratory to discontinue its liquid-waste ground disposal operation. (auth)

25071 (TID-7628(p.513-31)) MOVEMENT OF RUTHENIUM IN THE ORNL WASTE-PIT SYSTEM. K. E. Cowser (Oak Ridge National Lab., Tenn.).

A significant increase occurred in the amount and concentration of fission products released to the ORNL waste-pit system in 1959. The concentration of ruthenium in the chemical waste entering Pit 3 during September 1959 averaged about 2×10^8 d/m/ml or 90 uc/ml. Based upon assumed conditions and evaluation of past events, it is estimated that 24,000 curies of Ru^{106} may be released to the Clinch River each year without exceeding the calculated MPC_w value (continuous nonoccupational exposure) for the river. With the waste-pit system acting as the primary source of Ru^{106} that is discharged to the river, it is estimated that on an annual basis, concentration of Ru^{106} in waste released to the pit system should not exceed 25 uc/ml; this amounts to 350,000 curies of Ru^{106} in 3.7 million gallons of waste each year. Special treatment of the waste to enhance the removal of Ru^{106} was not considered in the calculations. The concentration of ruthenium in waste released to the pits in September 1959 was 3.6 times greater than the average annual concentration, and a continued discharge at this level could create a potential hazard in the river. No attempt has been made to establish an allowable concentration of Ru^{106} in waste released to the pits. Such a value is influenced by Laboratory policy regarding use of the natural environment for waste disposal, riparian rights for equitable use of the river, Federal and/or state regulations, and ultimately the effects of such release in the physical, chemical, and biological systems of the river. (auth)

25072 (TID-7628(p.532-5)) EVALUATION OF ULTIMATE DISPOSAL METHODS FOR LIQUID AND SOLID RADIOACTIVE WASTES. Status Report. J. J. Perona, R. L. Bradshaw, J. T. Roberts, and J. O. Blomeke (Oak Ridge National Lab., Tenn.). (ORNL-TM-86)

Cost studies of interim liquid storage and pot calcination of radioactive wastes based on a hypothetical 15,000 Mw nuclear economy are summarized. (auth)

25073 (TID-7628(p.536-68)) NATIONAL REACTOR TESTING STATION WASTE DISPOSAL PRACTICES AND PROGRAMS. Bruce L. Schmalz (Idaho Operations Office, AEC).

The purpose of the National Reactor Testing Station is to further the Atomic Energy Commission's reactor development program. It was established in 1949 in order to provide a place where various types of nuclear reactors and allied plants could be built and tested. Its size and relatively isolated location allow research in this field which would not be initially permissible in more populous areas. The NRTS is located on a level desert plain. The plain extends in a 350 mile arc across the southern part of the state of Idaho. The plain is formed by geologically young volcanic extrusions interbedded with lacustrine and alluvial sediments. The elevation at the northern end of the site is 4,800 feet, and at the southern end it is 5,500 feet. Many small volcanic craters and cones are evident. Three large volcanic buttes are the predominant land features, the highest of which is 3 miles south of the NRTS boundary, with an elevation of 7,550 feet. The other two are within the station, the higher being East Butte with an elevation of 6,600 feet. The earth mantle (regolith) over the bed rock (basalt) is composed of air and water borne sediments. The thickness and distribution of the regolith is influenced by the irregularities of the underlaying basalt and varies in depth from a few inches to over 100 feet. Along the west central north and south axis where the Big Lost River flows, the regolith is composed of alluvial sand and gravel. This river flows only intermittently. Water which does enter the NRTS either sinks along the channel or into playa areas. No surface flow from this or any stream leaves the NRTS. The

other smaller stream channels also enter the station but the water is diverted for irrigation and seldom reaches the station boundary. The ground water table occurs at depths ranging from 200 feet below land surface in the northern section of the station to 800 feet at the southern end. The water table has an average gradient of 5 feet per mile toward the southwest and consequently the ground water must flow in that direction. Recharge of the ground-water reservoir is by underground flow from the adjacent mountainous areas to the north, northwest, and northeast. Recharge from precipitation on the plain is very small. The precipitation is absorbed by the soil and consumed by evaporation and transpiration. The annual precipitation is less than 10 inches. The average temperature is 42°F. The prevailing wind is from the southwest. The research efforts at the station are localized in 10 separate areas. Disposal of aqueous liquid waste to the ground in these areas is accomplished by discharge into ponds, wells, cribs, cesspools, and one subirrigation sewer system. The amount of waste discharged at each area is tabulated. Results are reported from investigations of the movement of aqueous radioactive wastes through the regolith in the vicinity of waste disposal areas. (C.H.)

25074 (TID-7628(p.569-82)) THE POSSIBILITIES OF DISCHARGE OF RADIOACTIVE WASTES IN THE CRR ISPRA. G. Grison and R. Amavis (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy).

The Commun Research Centre of Ispra is situated in Northern Italy on the western boundary of the Province of Varese, at a distance of approximately 2 km from the Lombardian bank of the Lago Maggiore. The geology, hydrography, and hydrogeology of the area are described. Preliminary results are presented from a survey to locate a suitable place for the discharge of liquid radioactive waste after treatment or as a storage place for solid radioactive wastes. (C.H.)

25075 (TID-7628(p.583-9)) BRITISH THOUGHTS ON GROUND DISPOSAL OF RADIOACTIVE WASTES. R. H. Burns (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

In Great Britain ground disposal is not practised. This is not because it is considered an unsatisfactory process. The difficulties are in finding a suitable area, and persuading other people that the process is safe. In the United Kingdom both of these are real difficulties. Burial of solid waste can be considered as a form of ground disposal and a limited amount is carried out in Great Britian. Experiments are being carried out to investigate the possibility of converting solid waste, including chemical sludges, into a non-leachable form. This may be achieved by melting with suitable fluxes or, as the Belgians have proposed, by incorporation in asphaltic material. If the process is found to be satisfactory it is hoped that authorizations for burial may be revised and/or objections to sea dumping removed. (auth)

25076 (TID-7628(p.590-601)) I.A.E.A. WASTE MANAGEMENT PROGRAM. D. W. Pearce and I. C. Roberts (International Atomic Energy Agency, Vienna).

Radioactive waste management includes the treatment, processing, storage, transportation, disposal, and monitoring of radioactive wastes. Radioactive wastes must be managed as economically as possible, not only because of the cost of the technology itself and its effects on industry, but more importantly because of the largely irretrievable effect and immense costs of serious errors and accidents. Research projects on various phases of waste management sponsored by the International Atomic Energy Agency are outlined. (C.H.)

25077 THE RELEASE OF RADIOACTIVE MATERIALS IN WASTE WATER CHANNELS AND SURFACE WATERS. Rolf Plesch (Siemens & Halske A. G., Karlsruhe, Ger.). Atomkernenergie, 7: 224-9(June 1962). (In German)

The accumulated radioactive waste in an isotopes laboratory should be disposed of into the sewage only in quantities such that the values according to Schedule II of the First Radiation Protection Regulation are not exceeded on a daily average. This can be accomplished either solely by diluting with inactive water, or through deactivation with time, without diluting, or by a combination of both methods. The various methods are described and treated mathematically whereby general formulae, suitable in practice, are derived, the application of which is illustrated on the basis of examples. In this way, it is possible, even in the planning of an isotopes laboratory, to estimate quantitatively, the amounts of diluting water and the size of the storage volume, and to find an economically favorable solution, on the basis of a waste water activity balance. (auth)

25078 THE SUITABILITY OF PEAT FOR THE PURIFICATION OF RADIOACTIVE WASTE SOLUTIONS. II. THE ADSORPTION OF ZIRCONIUM AND RUTHENIUM COMPOUNDS ON PEAT. R. Winkler (Zentralinstitut für Kernphysik, Dresden). Isotopentechnik, 2: 50-5(Feb. 1962). (In German)

The adsorption of hydrolysis products of zirconium oxynitrates and of trinitratenitrosyl ruthenium on peat were investigated as functions of the contact time, pH value, quantity of solution, and sodium nitrate concentration. A significant superiority of the clay with respect to cation exchange resins was found. Ruthenium can be completely adsorbed from 0.005 M solution at pH 3 to 4 and zirconium from 0.04 M solution at pH > 3. It was shown that the hydroxides of the elements studied are present in colloidal distribution at these pH values. The colloids were adsorbed well on the porous extensive surface of the peat, whereas they cannot penetrate into the fine pores of the exchange resin. (tr-auth)

25079 ATMOSPHERIC DIFFUSION OF RADIOACTIVE CONTAMINATION FROM THE STACK OF A REACTOR. Tibor Hoffmann and Géza Németh. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei, 6: 275-84(July-Aug. 1958). (In Hungarian)

A formula is derived theoretically for the atmospheric diffusion of contamination taking into account the correct boundary conditions and half lives. The radioactive gases are characterized by the boundary condition that they are not adsorbed at all on the surface, whereas the aerosols are adsorbed on the ground at least in some degree. The solution of the diffusion equation is given with the proper boundary conditions by successive Hankel and Laplace transformations in an analytic form for the case of an impulse-form discharge of contamination from the chimney. The concentration value thus obtained is supplied by the factor taking into account the half life and then integrated for a given program of the discharge of the chimney (e.g., for constant operating). In the nonadsorbing case the contamination piled up on the ground is given by the value of the concentration, while in the adsorbing case the contamination per unit surface is given by the time integral of the contamination current directed toward the surface taking into account the half life. The effect of the wind can be taken into account by considering the

co-ordinate-system to be moved downwind with the speed of the wind before the evaluations of the time integrals and carrying out the integration only after this change in the formulas. Some relations are derived on this basis for the design of reactor stacks. The only uncertain parameter in the formulas is the effective diffusion constant of the contamination, which can be determined by the evaluation of certain measurements. (auth)

CORPORATE AUTHOR INDEX

This index contains entries for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the NSA volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

A

AEROJET-GENERAL CORP., AZUSA, CALIF.
Properties of W, Ta, and Mo, 16: 24162 (NP-11654)

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
Electrostatic shielding of high-energy protons, 16: 24903 (ASD-TDR-62-244)
Refractory metal alkoxides, 16: 24147 (ASD-TDR-62-90)
Ultrasonic propagation in deformed materials, 16: 23971 (ANL-6515(p.121-32))

AEROPROJECTS, INC., WEST CHESTER, PENNA.
Prog. rpt. on ultrasonic welding, 16: 24130 (AD-271377)

AEROSPACE CORP., EL SEGUNDO, CALIF.
Bibliography on BeO, 16: 24140 (AD-269729)
Proton spectrometer, 16: 23832 (AD-269867)

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, WASHINGTON, D.C.
Electric propulsion research, 16: 25030 (AFOSR-1632)

AIR PRODUCTS AND CHEMICALS, INC., ALLENTOWN, PENNA.
Thermodynamic data on O and N, 16: 23664 (ASD-TR-61-625)

AKADEMIYA NAUK S.S.S.R.
Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)

AKTIEBOLAGET ATOMENERGI, STOCKHOLM.
Distribution of neutrons from pulsed plane source, 16: 24758 (AE-71)
Electronic structure of MnB, 16: 23662 (AE-76)
Parameters for control rod cells, 16: 24930 (AE-75)

AKTIEBOLAGET ATOMENERGI, STUDSVIK, SWEDEN.
Resonance absorption of U metal and oxide, 16: 24759 (AE-77)

ALCO PRODUCTS, INC., SCHENECTADY, N. Y.
Hazards report for PM-2A Core II, 16: 24966 (APAE-121)
Thermal analysis of Type 3 elements, 16: 24965 (APAE-105)

ALLIS-CHALMERS MFG. CO., MILWAUKEE.
Prog. rpt. on Pathfinder, 16: 24962 (ACNP-62005)

ALLIS-CHALMERS MFG. CO. ATOMIC ENERGY DIV., WASHINGTON, D.C.
Effects of accident relevant to containment design, 16: 24997 (TID-15734)
Fuel assembly handling, EGCR, 16: 24989 (TID-6702)

AMERICAN ASSN. OF PETROLEUM GEOLOGISTS, TULSA, OKLA.
Deep-well disposal, 16: 25057 (TID-7628(p.347-55))

AMERICAN CYANAMID CO. ATOMIC ENERGY DIV., WATERTOWN, MASS.
Prog. rpt. on processing U ores, 16: 23770 (ACCO-17)
Recovery of U from ore, 16: 23771 (ACCO-24)
Substitutes for glue in ore treatment, 16: 23769 (ACCO-2)

AMERICAN CYANAMID CO. ATOMIC ENERGY DIV. RAW MATERIALS DEVELOPMENT LAB., WINCHESTER, MASS.
Ion exchange recovery of U, 16: 23778 (ACCO-44)
Ion exchange studies on acid leach liquor, 16: 23772 (ACCO-37)

AMES LAB., AMES, IOWA.
Bibliography on diffusion in ceramic systems, 16: 24157 (IS-448)
Prog. rpt. on metallurgy, 16: 24108 (IS-351)
Prog. rpt. on physics, 16: 24277 (IS-349)

AMF ATOMICS. DIV. OF AMERICAN MACHINE AND FOUNDRY CO., GREENWICH, CONN.
Hazards report for Ames Research Reactor, 16: 25024 (TID-14881)

AMMANN AND WHITNEY, NEW YORK.
Underground personnel shelters, 16: 24020 (WT-1454)
Underground shelters tested at Plumbbob, 16: 24019 (WT-1453)

ANACONDA CO., GRANTS, N. MEX.
Deep well disposal of U tailing water, 16: 25058 (TID-7628(p.356-62))

ANSCO DIV., GENERAL ANILINE AND FILM CORP., BINGHAMTON, N. Y.
Meaning of characteristic curves, 16: 23968 (ANL-6515(p.87-101))

ARGENTINA. COMISIÓN NACIONAL DE ENERGÍA ATÓMICA, BUENOS AIRES.
Activities of radioisotopes, 16: 23712 (NP-11744)
Excitation function of $Al^{27}(d,p)Al^{28}$, 16: 24785 (NP-11748)
Tellurium-121 isomeric pairs in Sb-121(d,2n) reaction, 16: 24786 (NP-11791)

ARGENTINA. UNIVERSIDAD NACIONAL DE LA PLATA.
Tellurium-121 isomeric pairs in Sb-121(d,2n) reaction, 16: 24786 (NP-11791)

ARGONNE NATIONAL LAB., ILL.
Air analyses of halogenated hydrocarbons, 16: 23384 (TID-7616(p.211-21))
Chlorination of U and fission product oxides, 16: 23663 (ANL-6546)
Color radiography, 16: 23975 (ANL-6515(p.203-17))
Crystallographic D-space computer program, 16: 23527 (ANL-6519)
Liquid-phase sintering of Mo alloys, 16: 24145 (ANL-6268)
Measurements of Cu(p,n) cross sections, 16: 24793 (TID-12696)
Mechanical vibrations in solid rods, 16: 23972 (ANL-6515(p.133-61))
Modification of EBWR for higher-power operation, 16: 24964 (ANL-6552)
Neutron radiography, 16: 23965 (ANL-6515(p.28-52))
Prog. rpt. on boiling water reactor. I., 16: 24931 (ANL-6561)
Symposium on physics and nondestructive testing, 16: 23963 (ANL-6515)

ARMY CHEMICAL CORPS NUCLEAR DEFENSE LAB., ARMY CHEMICAL CENTER, MD.
Initial γ spectrograph, 16: 23844 (NDL-TR-20)

ARNOLD ENGINEERING DEVELOPMENT CENTER, ARNOLD AF STATION, TENN.
Gas dynamics of Ar plasma, 16: 24879 (AEDC-TDR-62-88)

ATHENS. UNIV.
Prog. rpt. on radiation effects on blood and bone marrow, 16: 23415 (TID-16080)

ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
Communal shelter evaluation, 16: 23359 (WT-360)
Ground disposal program 1959-61, 16: 25040 (TID-7628(p.12-16))
Land burial of radioactive wastes, 16: 25062 (TID-7628(p.396-427))
Publication of AEC measurement methods, 16: 23635 (TID-7629(p.259-

66))
Radioactive waste burial sites, 16: 25063 (TID-7628(p.428-36))
ATOMIC ENERGY OF CANADA LTD., CHALK RIVER, ONT.
Computer study of reactor fueling, 16: 24932 (CRRP-1087)
Data plotting system for use with punched paper tape, 16: 23843 (CREL-1009)
Disposal facilities, AECL, 16: 25038 (TID-7628(p.3-9))
Examination of irradiated SAP clad UO_2 fuel element, 16: 24235 (CRFD-1084)
Fission product poisoning from fission of U-238, 16: 24779 (CRRP-1090)
Growth of nuclear power, 16: 24978 (DL-49)
Monitoring of nepheline syenite glass disposals, 16: 25039 (TID-7628 (p.9-12))
ATOMIC ENERGY OF CANADA LTD. CHALK RIVER PROJECT, CHALK RIVER, ONT.
Multipurpose readout scaler, 16: 23842 (CREL-952)
Neutron absorption in composite cylinder, 16: 24760 (CRT-1079)
Radiation hazards at Chalk River, 16: 24009 (CRRIS-1071)
ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.
Control of heat flow across an annulus, 16: 23821 (NAA-SR-Memo-7182)
Critical heat flux of Santowax R, 16: 24947 (NAA-SR-Memo-6907)
Effect of reactor core length, 16: 24946 (NAA-SR-Memo-4325(Rev.1))
Fuel handling machine shielding, 16: 24948 (NAA-SR-Memo-7212)
Hallam exponential lattices containing UC fuel elements, 16: 24984 (NAA-SR-Memo-7134)
Monte Carlo evaluation of fast neutron collimators, 16: 24905 (NAA-SR-Memo-7347)
Pressure drop produced by rod bundle spacers, 16: 24279 (NAA-SR-Memo-6782)
Properties of PbTe, 16: 24161 (NAA-SR-Memo-7172)
Subcooled nucleate boiling in Santowax R, 16: 23820 (NAA-SR-6891)
AUSTRALIA. ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT, LUCAS HEIGHTS, NEW SOUTH WALES.
Concentric tubular reactor fuel elements, 16: 24929 (AAEC/E-89)
Removing traces of radioactivity from water, 16: 25033 (AAEC/TM138)

B

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Shock waves from exploding wires, 16: 24273 (BRL-1152)
BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Corrosion analysis of VPP components, 16: 24118 (BMI-X-201)
Prog. rpt. on coatings for Ta-base alloys, 16: 24148 (ASD-TR-61-676)
Prog. rpt. on USAEC/AECL cooperative program, 16: 24149 (BMI-X-204)
Radiation damage in compound semiconductors, 16: 24234 (ARL-62-343)
BATTELLE MEMORIAL INST. DEFENSE METALS INFORMATION CENTER, COLUMBUS, OHIO.
Beryllium for structural applications, 16: 24096 (DMIC-168)
Decarburization effects on steels, 16: 24152 (DMIC-Memo-154)
Electron-beam welding of W, 16: 24131 (DMIC-Memo-152)
Properties of Mar-Aging steels, 16: 24153 (DMIC-Memo-156)
Selected accessions, 16: 24111 (NP-11825)
BATTELLE MEMORIAL INST. RADIATION EFFECTS INFORMATION CENTER, COLUMBUS, OHIO.
Radiation Effects Accession List 59, 16: 24242 (NP-11856)
BELL TELEPHONE LABS., INC., WHIPPANY, N. J.
Generation of uhf sound waves in solids, 16: 23970 (ANL-6515(p.117-20))
BOEING CO., SEATTLE.
Two-dimensional hydromagnetic steady flows, 16: 24887 (D1-82-0170)
BOSTON UNIV.
Prog. rpt. on effects of radiation on adrenocortical tissue, 16: 23417 (TID-16122)
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Computer learns to see, 16: 24087 (BNL-725)
Neutron Cross Section Newsletter No. 6, 16: 24776 (BNL-732)
Prog. rpt. on nuclear engineering, 16: 23352 (BNL-705)
Silicon surface barrier particle detectors, 16: 23838 (BNL-737)
BROWN UNIV., PROVIDENCE.
Electrical conductivity of high-temperature gases, 16: 24282 (NP-11906)
Prog. rpt. on high-energy physics, 16: 23850 (TID-16074)
BRUSSELS. CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE.
Bibliography on I-132, 16: 23665 (BLG/B-2)
Bibliography on I-133, 16: 23666 (BLG/B-3)
Flow tests of BR-2 fuel elements, 16: 24985 (NDA-2561-1)
Maximum credible accident of BR-2 reactor, 16: 25014 (BLG-99)
Thermal cross sections and homogeneous burnup of reactor, 16: 25013 (BLG-69)
BRUSSELS. UNIVERSITE.
Mass spectrometric study of B–C, 16: 24177 (WADD-TR-60-782(Pt.VIII))
BUFFALO. UNIV.
Prog. rpt. on nuclear chemistry, 16: 23529 (TID-16024)
BUREAU OF MINES, BARTLESVILLE, OKLA.
Injecting solutions into permeable rocks, 16: 25056 (TID-7628(p.324-44))
BUREAU OF MINES, PITTSBURGH.
Hazards in use of liquid H in bubble chambers, 16: 24015 (TID-15985)

C

CALIFORNIA INST. OF TECH., PASADENA.
Astronautics information, Vol. V., No. 4, 16: 25032 (NP-11619)
Compressible viscous vortex, 16: 23818 (JPL-TR-32-290)
Energy spectrum of fission particles leaving fuel sheet, 16: 24783 (JPL-TR-34-249)
Nuclear-electric spacecraft, 16: 25031 (JPL-TR-32-232)
CALIFORNIA. UNIV., BERKELEY.
Injection disposal, 16: 25055 (TID-7628(p.303-23))
CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Prog. rpt. on inorganic materials, 16: 24175 (UCRL-10119)
Reactions $K^- + p \rightarrow K + N + (\pi)$ at 1.15 Bev/c, 16: 24701 (UCRL-10120)
SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)
CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Gamma energy deposition in infinite source media, 16: 24287 (UCRL-6891)
Gnome temperature and radiation studies, 16: 23356 (PNE-106P)
Shock hydrodynamics, 16: 24286 (UCRL-6797)
Urinalysis for Cm, 16: 23374 (TID-7616(p.39-50))
CALIFORNIA. UNIV., LOS ANGELES.
Determining tritium water in urine, 16: 23642 (UCLA-504)
CANADA. DEPT. OF MINES AND TECHNICAL SURVEYS.
Refining of U, 16: 23774 (NP-11877)
CANADA. DEPT. OF MINES AND TECHNICAL SURVEYS. MINES BRANCH.
Determination of U, 16: 23604 (NP-11873)
CANADIAN GENERAL ELECTRIC CO., LTD., PETERBOROUGH, ONT.
Mechanical properties of Al alloys, 16: 24171 (R61CAP69)
CARBORUNDUM CO., NIAGARA FALLS, N. Y.
Thermal shock resistance of ceramic bodies, 16: 24176 (WADD-TR-60-10 (Pt.II))
CARNEGIE INST. OF TECH., PITTSBURGH.
Cosmogenic C-14 and Cl-36 in meteorites, 16: 23984 (NYO-8922)
Ionic compounds of Fe-57, 16: 23713 (NP-11788)
Prog. rpt. on nuclear chemistry, 16: 24699 (TID-15820)
Symmetry properties of S matrix, 16: 24916 (NP-11738)
CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CHARLOTTE, N. C.
CVTR controlled plant study, 16: 24972 (CVNA-138)
Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)
CENTRAL UTILITIES ATOMIC POWER ASSOCIATES.
Prog. rpt. on Pathfinder, 16: 24962 (ACNP-62005)
CENTRO INFORMAZIONI STUDI ESPERIENZE, MILAN.
Wet steam cooling experiments, 16: 23816 (EURAEC-42)
CHEMICAL CORPS, ARMY CHEMICAL CENTER, MD.
Deep well fluid waste disposal, 16: 25059 (TID-7628(p.363-73))
CHICAGO. UNIV. LABS. FOR APPLIED SCIENCE.
Arc jet for producing temperature simulation in wind tunnel, 16: 24885 (ASD-TR-61-283)
CHILE. UNIVERSIDAD, SANTIAGO.
Neutron reactions (n,p) and (n,γ), 16: 24787 (NP-11793)
CLIMAX MOLYBDENUM CO., NEW YORK.
Bibliography on MoS_2 as lubricant, 16: 24167 (NP-11899)
COLUMBIA UNIV., NEW YORK.
Corrections to $K \rightarrow e\nu$ and $K \rightarrow \mu\nu$ decays, 16: 24700 (TID-16108)
COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
Cost analysis and development of maritime reactor, 16: 24971 (CEND-19

(Pt.I))
Pt. final design report (suppl.), 16: 24970 (CEND-135(Vol.I Suppl.))
Steam separation requirements for boiler-superheater reactors, 16: 24969 (CEND-116)
COMPAGNIE GÉNÉRALE DE TÉLÉGRAPHIE SANS FIL, PARIS.
Batch loop for study of pre-irradiated samples, 16: 24106 (EURAEC-57 (App.9))
Preparation of UO_2 in powder room, 16: 24098 (EURAEC-57(App.1))
Preparation of UO_2 powder for Piat (Turin), 16: 24101 (EURAEC-57 (App.4))
Resistance to thermal shock, 16: 24103 (EURAEC-57(App.6))
Thermal conductibility by radial flow, 16: 24104 (EURAEC-57(App.7))
UO_2 sinterings preliminary to irradiations in EL3, 16: 24105 (EURAEC-57(App.8))
Use of wet H_2 as sintering atmosphere, 16: 24102 (EURAEC-57(App.5))
COMPAGNIE INDUSTRIELLE DES COMBUSTIBLES ATOMIQUES FRITTES, CORBEVILLE, PAR ORSAY (SEINE-ET-OISE), FRANCE.
Uranium dioxide shaping, 16: 24099 (EURAEC-57(App.2))
CONSOLIDATION COAL CO. RESEARCH AND DEVELOPMENT DIV., LIBRARY, PENNA.
Prog. rpt. on radioisotopes in coal research, 16: 24035 (NYO-9851)
CORNELL UNIV., ITHACA, N. Y.
Condensation behind normal shocks, 16: 24889 (NP-11601)
CURTISS-WRIGHT CORP., PRINCETON, N. J.
Solar thermoelectric generators, 16: 25029 (AD-269180)
CURTISS-WRIGHT CORP. RESEARCH DIV., QUEHANNA, PENNA.
Analysis of dense BeO, 16: 23624 (TID-7629(p.135-41))

D

DELFT, NETHERLANDS. TECHNISCHE HOGESCHOOL.
Energy distribution of γ rays, 16: 24693 (NP-11538)
DENVER. UNIV. DENVER RESEARCH INST.
Oxidation of beryllides, 16: 24123 (TID-16030)
Oxidation resistance of $NbAl_3$, 16: 24174 (TID-16032)
DEUTSCHES ELEKTRONEN-SYNCHROTRON, HAMBURG.
Configuration of DESY magnet, 16: 24870 (UCRL-Trans-816)
DIAMOND ORDNANCE FUZE LABS., WASHINGTON, D. C.
Trija dosimetry. I., 16: 25016 (DOFL-TM-60-27)
DIVISION OF BIOLOGY AND MEDICINE, AEC.
Aeroradioactivity survey and geology of Hanford area, 16: 23983 (CEX-59.4.11)
Radiation in shelters and instrumentation, 16: 24016 (WT-789)
DIVISION OF REACTOR DEVELOPMENT, AEC.
Aspects of WTR and SL-1 accidents, 16: 25021 (IDO-19308)
DIVISION OF TECHNICAL INFORMATION EXTENSION, AEC.
Bibliographies of atomic energy literature, 16: 23358 (TID-3711)
DOW CHEMICAL CO. ROCKY FLATS DIV., DENVER.
Thulium canning methods, 16: 24133 (RFP-268)
DU PONT DE NEMOURS (E. I.) & CO., WILMINGTON, DEL.
Irradiation of U–2% Zr fuel tube, 16: 24237 (DP-709)
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
Portable B-γ survey meter, 16: 24011 (DP-711)
Stresses in stainless steel during irradiation, 16: 24236 (DP-669)
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER PLANT, AIKEN, S. C.
Burial of solid radioactive wastes, 16: 25066 (TID-7628(p.462-8))
Containment of radioactive wastes in underground caverns, 16: 25061 (TID-7628(p.380-95))
Disposal radioactive wastes to ground, 16: 25044 (TID-7628(p.115-29))
DUBLIN INST. FOR ADVANCED STUDIES.
Doublet scheme for leptons, 16: 24694 (NP-11731)
DUBLIN. UNIVERSITY COLL.
Doublet scheme for leptons, 16: 24694 (NP-11731)
DUQUESNE LIGHT CO., SHIPPINGPORT, PENNA.
Emergency plan for Shippingport reactor, 16: 24010 (DLCS-5020100)
Prog. rpt. on Shippingport PWR, 16: 24980 (DLCS-5000562)
Prog. rpt. on Shippingport PWR, 16: 24995 (TID-15224)
Reactor coolant system pressure drop, 16: 24979 (DLCS-1470107(Rev.))

E

EASTMAN KODAK CO., ROCHESTER, N. Y.
Latent image, 16: 23967 (ANL-6515(p.81-6))
Radiographic sensitivity, 16: 23969 (ANL-6515(p.102-16))
EUROPEAN ATOMIC ENERGY COMMUNITY. NUCLEAR RESEARCH CENTER, ISPRA, ITALY.
Discharge of radioactive wastes in Ispra, 16: 25074 (TID-7628(p.569-82))
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
CERN proton synchrotron. III., 16: 24865 (CERN-62-3)

F

FEDERAL CIVIL DEFENSE ADMINISTRATION, BATTLE CREEK, MICH.
Atomic explosion effects on shelters, 16: 24018 (WT-1161)
FENWAL ELECTRONICS, INC., FRAMINGHAM, MASS.
Thermistors, 16: 23974 (ANL-6515(p.187-201))
FLORIDA. UNIV., GAINESVILLE.
Prog. rpt. on nuclear properties of Re, 16: 24789 (NP-11874)
FRANCE. CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, PARIS.
Heavy water analyzer, 16: 23623 (TID-7629(p.91-109))
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE, PARIS.
Prog. rpt. on sintered UO_2, 16: 24097 (EURAEC-57)
Uranium oxide sintering furnace, 16: 24100 (EURAEC-57(App.3))
FRANCE. COMMISSARIAT À L'ENERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, FONTENAY-AUX-ROSES.
Determination of flux/ev with Au foil detectors, 16: 23841 (CEA-2162)
FRANCE. COMMISSARIAT À L'ENERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, GRENOBLE.
Accumulation of radioelements in plant tissue, 16: 23406 (CEA-2131)
Action of x-rays on plasma proteins, 16: 23412 (CEA-2132)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Bubble studies, 16: 24274 (CEA-BIB-26)
Cross sections in neutron photoproduction, 16: 24778 (CEA-2148)
Determination of impurities in Cs-137, 16: 23631 (TID-7629(p.209-16))
Effect of column length on Sr-90 removal, 16: 25051 (TID-7628(p.211-13))
Gold-198 and I-131 in diagnosis of hepatic affections, 16: 23371 (CEA-1994)
High-temperature microscope, 16: 23839 (CEA-2082)
Nuclear excitation by α scattering, 16: 24777 (CEA-2146)
Prog. rpt. on C–U–Th system, 16: 24179 (AEC-tr-5174)
Properties in molten LiCl–KCl, 16: 23675 (HW-tr-40)
Separation of metallic elements by anion exchange resins. II., 16: 23673 (AEC-tr-5098)
Separation of Zr and Hf, 16: 23792 (AEC-tr-5099)
Study of $\pi^- + p \rightarrow \pi^0 + n$ and $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ reactions, 16: 24677 (CEA-2136)
Thiazinic and indaminic dye syntheses induced by radiation, 16: 23708 (CEA-1991)
Treatment of solid radioactive waste, 16: 25034 (CEA-2147)
FRANKFORD ARSENAL, PHILADELPHIA.
Transition phase in Mg–Li–Al–Zn alloy, 16: 24164 (NP-11778)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Charge transfer in collisions, 16: 24780 (GA-2783)
Ion-neutral collisions in afterglow, 16: 24276 (GA-2824)
Nuclear data for GAM-I data tape, 16: 24088 (GA-2451(Vol.II))
Preparation of graphite matrix fuel compacts, 16: 24119 (GAMD-2221)
Prog. rpt. on carbides for thermionic space reactors, 16: 24154 (GA-3245)
GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.
Transport equations for upper atmosphere, 16: 23989 (ZPh-108)
GENERAL DYNAMICS/FORT WORTH. DIV. OF GENERAL DYNAMICS CORP., FORT WORTH, TEX.
Analysis of radiation heating experiment, 16: 24240 (NARF-61-40T)
GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION DEPT., CINCINNATI.
By-pass valve bearing development, 16: 23801 (DC-60-1-37)
Design data on Inconel X, 16: 24151 (DC-61-2-133)
Effect of γ radiation on insulating materials, 16: 24244 (TID-15981)
Fission product retention on metallic surface, 16: 23779 (DC-61-6-5)
Foreign gas cooled reactors, 16: 24975 (DC-60-10-154)

Fuel element cracking, 16: 24934 (DC-60-11-103)
Outside test tank activation tape data, 16: 24904 (DC-61-2-98)
Plant disassembly procedure for D102A, 16: 24977 (DC-61-6-16)
Reactor analysis program for IBM-704, 16: 24935 (DC-61-2-97)
Startup instrumentation, 16: 24974 (DC-55-7-61)

GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION DEPT., IDAHO FALLS, IDAHO.
Decontamination of D140E-1 power plant, 16: 24976 (DC-60-10-726)
Power calibration of Susie reactor, 16: 24933 (DC-60-6-722)

GENERAL ELECTRIC CO. ATOMIC POWER EQUIPMENT DEPT., SAN JOSE, CALIF.
Analyses of radial separator, 16: 24936 (GEAP-4012)
Diffusion of charged particles in scattering medium, 16: 24676 (APED-3960)
Investigation of B_4C–Ni electro dispersions, 16: 24107 (GEAP-3831)
Materials for nuclear superheat applications, 16: 24155 (GEAP-3875)

GENERAL ELECTRIC CO. ELECTRONICS LAB., SYRACUSE, N. Y.
Thermocouple energy converters, 16: 23831 (AD-269034)

GENERAL ELECTRIC CO. FLIGHT PROPULSION LAB. DEPT., CINCINNATI.
Design technology for GCR. I-III., 16: 24967 (APEX-800(Pt.A))
Design technology for GCR. VIII., 16: 24968 (APEX-800(Pt.F))
Prog. rpt. on high-temperature materials, 16: 24238 (GEMP-12A)
Prog. rpt. on Nb alloy (AS-55), 16: 24165 (NP-11824)
Program for approximating cross section dependence on energy, 16: 24678 (GEMP-113)
Program for averaging differential scattering cross sections, 16: 24679 (GEMP-115)
Program for computation of total macroscopic cross section and collision probabilities, 16: 24089 (GEMP-114)
Program for computing nuclear excitation and transition probabilities, 16: 24091 (GEMP-117)
Program for preparation of spectrum tables, 16: 24090 (GEMP-116)

GENERAL ELECTRIC CO. GENERAL ENGINEERING LAB., SCHENECTADY, N. Y.
Bibliosbstract on radiation effects, 16: 24233 (57GL77)
Machinery systems and control, 16: 24963 (AD-269402)
Main propulsion "steamotor", 16: 23798 (AD-269390)
Prog. rpt. on fluid transmissions, 16: 23800 (AD-269399)
Submarine power transmissions, 16: 23799 (AD-269398)
Surface films in lubrication, 16: 23803 (R60GL185)

GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Alkaline earth determinations, 16: 23601 (HW-69677)
Boiling heat transfer and burnout correlations, 16: 23817 (HW-71684)
Decontamination of PWR systems, 16: 24939 (HW-SA-2548)
Environmental testing of reactor materials, 16: 24239 (HW-SA-2547)
Flow in porous media, 16: 25045 (TID-7628(p.130-44))
French and British methods in reactor theory, 16: 24938 (HW-71649)
Geohydrologic features affecting waste disposal, 16: 25042 (TID-7628 (p.77-98))
Ground waste disposal at Hanford, 1959-61, 16: 25069 (TID-7628(p.491-505))
Hanford studies in geochemistry, 16: 25052 (TID-7628(p.214-36))
In-cell γ analyzer, 16: 23618 (TID-7629(p.42-53))
Inhibition of corrosion of stainless steel in HNO_3–HF mixtures, 16: 24120 (HW-73211)
Mineral adsorption of radionuclides, 16: 25035 (HW-69225)
Prog. rpt. on evaluation of radiological conditions, 16: 23409 (HW-73366)
Rupture model for fuel elements, 16: 24937 (HW-70400)
Shielding for Pu reclamation facility, 16: 23780 (HW-68021)
Solvent extraction of irradiated U fuels, 16: 23781 (HW-SA-2458)

GENERAL ELECTRIC CO. LIGHT MILITARY ELECTRONICS DEPT., UTICA, N. Y.
Thermocouple energy converters, 16: 23831 (AD-269034)

GENERAL ELECTRIC CO. MISSILE AND SPACE VEHICLE DEPT., PHILADELPHIA.
Interaction of plasma stream with geomagnetic fields, 16: 24657 (R62SD30)

GENERAL ELECTRIC CO. RESEARCH LAB., SCHENECTADY, N. Y.
Decay of conductivity in high electron density, 16: 24881 (AFCRL-1119)

GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., SAN JOSE, CALIF.
Diffusion of electrons in neutral gas, 16: 24272 (APED-3959)

GENERAL NUCLEAR ENGINEERING CORP., DUNEDIN, FLA.
BONUS zero power critical experiments, 16: 24981 (GNEC-198)

GENERAL TELEPHONE AND ELECTRONICS LABS. INC., BAYSIDE, N. Y.
Prog. rpt. on coatings for Ta-base alloys, 16: 24163 (NP-11711)

GENERAL TELEPHONE AND ELECTRONICS LABS. INC., PALO ALTO, CALIF.
Prog. rpt. on energy transfer in plasmas, 16: 24891 (RADC-TN-61-222)

GEOLOGICAL SURVEY, IDAHO FALLS, IDAHO.
Geophysical research at NRTS, 16: 25043 (TID-7628(p.99-114))

GEOLOGICAL SURVEY, WASHINGTON, D. C.
Aeroradioactivity survey and geology of Hanford area, 16: 23983 (CEX-59.4.11)
Data on tuff of tunnel system, Nevada Test Site, 16: 23987 (TEI-811)
Geology of tunnels, Nevada Test Site, 16: 23988 (TEI-817)
Ground studies of radioactive wastes, 16: 25053 (TID-7628(p.237-47))
Management of radioactive wastes, 16: 25041 (TID-7628(p.67-76))
Radioactive waste burial sites, 16: 25063 (TID-7628(p.428-36))

GEORGIA INST. OF TECH., ATLANTA. ENGINEERING EXPERIMENT STATION.
Prog. rpt. on high temperature ceramics, 16: 24132 (NP-11713)

GEOLOGICAL SURVEY, ALBUQUERQUE, N. MEX.
Dispersion in fluid flow by geologic features, 16: 25047 (TID-7628(p.166-78))

GLASGOW UNIV.
Low energy scattering theory, 16: 24912 (AD-270903)

GT. BRIT.
Radio-Sr and -Cs in drinking water, 16: 24033

GT. BRIT. NATIONAL ENGINEERING LAB., EAST KILBRIDE, GLASGOW.
High-temperature lubrication, 16: 23802 (NP-11683)

GRENOBLE, FRANCE. UNIVERSITÉ.
Alpha spectrometry using junction detectors, 16: 23840 (CEA-2138)

H

HAUSNER (HENRY H.), NEW YORK.
Bibliography on effects of high pressures on materials, 16: 24115
Properties of Be, 16: 24218

HIGH VOLTAGE ENGINEERING CORP., BURLINGTON, MASS.
Activation analysis for materials testing, 16: 23964 (ANL-6515(p.9-27))

HUGHES AIRCRAFT CO., CULVER CITY, CALIF.
Prog. rpt. on refractory materials, 16: 24178 (WAL-TR-766-3/1-3)

I

IDAHO OPERATIONS OFFICE, AEC.
Determination of Ra-226 and Th-230, 16: 23383 (TID-7616(p.147-75))
Waste disposal practices, 16: 25073 (TID-7628(p.536-68))

ILLINOIS INST. OF TECH., CHICAGO. ARMOUR RESEARCH FOUNDATION.
Liquid-phase sintering of Mo alloys, 16: 24145 (ANL-6268)
Neutron imaging, 16: 23966 (ANL-6515(p.53-80))
Prog. rpt. on Fe–Cr–Al alloys, 16: 24156 (GV-298)
Prog. rpt. on Zr alloys, 16: 24117 (ARF-2198-28)

ILLINOIS. UNIV., URBANA.
Fatigue of metals, 16: 24172 (SSC-137)
Magnetic properties of He-3, 16: 24284 (TID-15973)
Transverse magnetic coefficients K(y) and L(y), 16: 23835 (AFOSR-265)
Transverse polarization of internal conversion electrons, 16: 24784 (NP-11622)

INDIA. ATOMIC ENERGY ESTABLISHMENT, TROMBAY.
Calibration of GM counters for Ra, 16: 23833 (AEET/AM/24)

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Bibliography on effects of radiation on metals and alloys, 16: 24269 (STI/PUB/21/6)
Bibliography on geology of U and Th, 16: 24008 (STI/PUB/21/4)
Conference on radioisotopes. III., 16: 23547
Waste management program, IAEA, 16: 25076 (TID-7628(p.590-601))

ISOTOPES, INC., WESTWOOD, N. J.
Nuclear debris in precipitation, 16: 23985 (NYO-9532)

Prog. rpt. on Project Star Dust, 16: 23407 (DASA-1302)
ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Determination of Te in presence of Bi, 16: 23602 (IA-639)
Volatilities of H_2O^{17}/H_2O^{18}, 16: 23667 (IA-728)
ISRAEL INST. OF TECH., HAIFA.
Collective modes in plasma due to transverse interaction, 16: 24883 (ARL-251)
Statistical distribution of stochastic fields, 16: 24882 (ARL-250)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ISPRA.
Colorimetric determination of U, 16: 23600 (CNI-57)
Television camera for Ispra-1 control room, 16: 25015 (CNEN-134)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ROME.
Pulse scalers and preselectors, 16: 23845 (NP-11734)
Uranium alloys containing Mo and C, 16: 24150 (CNEN-113)
ITALY. COMITATO NAZIONALE PER LE RICERCHE NUCLEARI. FRASCATI LABORATORI.
Preventing resonance discharge in cavity resonator, 16: 24869 (AERE-Trans-890)
ITALY. ISTITUTO SUPERIORE DI SANITÀ, ROME.
Photoproduction in H of ω^0 meson, 16: 24680 (ISS-61/41)

J

JACKSON AND MORELAND, INC., BOSTON.
PM-3A secondary shielding, 16: 24996 (TID-15477)
JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
Critical experiments and characteristics of JRR-2, 16: 25022 (JAERI-1025)
JAPAN ATOMIC INDUSTRIAL FORUM, INC., TOKYO.
Abstracts of 4th Japan conference on radioisotopes, 16: 23354 (NP-11767)
JAPAN RADIOISOTOPE, INC., TOKYO.
Abstracts of 4th Japan conference on radioisotopes, 16: 23354 (NP-11767)
JOHNS HOPKINS UNIV., BALTIMORE.
Conference on ground disposal of radioactive wastes, 16: 25037 (TID-7628)
Land burial of radioactive wastes, 16: 25062 (TID-7628(p.396-427))
JOHNSTON (WILLIAM H.) LABS., INC., BALTIMORE.
Training experiments in radiation chemistry, 16: 23710 (JLI-650-2-1 (Vol.I))
Training experiments in radiation chemistry, 16: 23711 (JLI-650-2-1 (Vol.II))
JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Anomalies in μ^- meson decay in mesoatoms, 16: 24278 (JINR-P-971)
Conserved vector current hypothesis, 16: 24691 (JINR-P-968)
Detection of charge exchange in π^- mesons, 16: 24689 (JINR-P-948)
Elastic neutrino and antineutrino scattering, 16: 24688 (JINR-P-947)
Electron acceleration in annular synchrocyclotron, 16: 24866 (JINR-P-914)
Electron load of cyclotron resonator, 16: 24867 (JINR-P-962)
Exchange pion-nucleon scattering, 16: 24690 (JINR-P-966)
Hypercharge and degeneracy in respect to isotopic spin, 16: 24681 (JINR-(I-976)
Integral equation of type of low-scattering equation, 16: 24913 (JINR-P-890)
Interaction of π^- mesons with He, 16: 24682 (JINR-P-868)
Interactions of gaseous $ZrCl_4$, $HfCl_4$, $NbCl_5$, and $TaCl_5$, 16: 23709 (JINR-P-957)
Newton-Wigner coordinate for scalar particle, 16: 24686 (JINR-P-939)
Nuclear reaction $Th^{232}(Ne^{22},4n)Fm^{250}$, 16: 24781 (JINR-P-896)
On charge exchange of π^- mesons, 16: 24685 (JINR-P-928)
On n-p scattering of 200-Mev neutrons, 16: 24684 (JINR-P-920)
Operators in low-scattering equation, 16: 24914 (JINR-P-901)
Phase analysis of nucleon-nucleon scattering, 16: 24687 (JINR-P-944)
Phase analysis of nucleon-nucleon scattering, 16: 24692 (JINR-P-970)
Protons accelerated in 10-Bev synchrophasotron, 16: 24871 (UCRL-Trans-843)
Scattering of γ quanta and polarization of nuclei and nucleons, 16: 24782 (JINR-P-967)
Surface of special points of Feynman's diagram, 16: 24683 (JINR-P-889)

K

KAISER ENGINEERS. DIV. OF HENRY J. KAISER CO., OAKLAND, CALIF.
Fuel assembly handling, EGCR, 16: 24989 (TID-6702)
Nuclear power cost evaluation, 16: 24990 (TID-7025(Vol.1))
Nuclear power cost evaluation, 16: 24991 (TID-7025(Vol.2))
Nuclear power cost evaluation, 16: 24992 (TID-7025(Vol.3))
Nuclear power cost evaluation, 16: 24993 (TID-7025(Vol.4))
Nuclear power cost evaluation, 16: 24994 (TID-7025(Vol.5))
KANSAS STATE UNIV., MANHATTAN.
KSU pile standardization, 16: 24761 (TID-15667)
KANSAS. UNIV., LAWRENCE.
Effect on neutrons and x rays on grasshopper embryos, 16: 23413 (TID-15962)
Flux and spectrum measurements in training reactor, 16: 25025 (TID-15977)
KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
MINK (MUFT-KATE into KARE), 16: 24093 (KAPL-M-RPC-4)
Pressure drop review for NCR, 16: 23819 (KAPL-M-WAG-1)
Solid-state mass spectrometry, 16: 23625 (TID-7629(p.142-50))

L

LITTLE (ARTHUR D.) INC., CAMBRIDGE, MASS.
Prog. rpt. on effect of electrophilic additives on radiolytic products, 16: 23714 (NYO-10023)
LOCKHEED MISSILES & SPACE CO., SUNNYVALE, CALIF.
Bibliography on radiation effects on electronic components, 16: 24241 (NP-11852)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Determination of W in Ta, 16: 23619 (TID-7629(p.55-61))
Determination of Mo and W in Pu, 16: 23620 (TID-7629(p.62-8))
Determination of burnup in Pu reactor fuels, 16: 23628 (TID-7629(p.177-83))
Determination of specific activity of Pu, 16: 23629 (TID-7629(p.185-92))
Estimation of fast neutron doses in man, 16: 23379 (TID-7616(p.89-97))
High-speed computers in Pu analyses, 16: 23630 (TID-7629(p.193-208))
Movement of Pu through LA tuff, 16: 25054 (TID-7628(p.248-81))
Plutonium electrorefining, 16: 24109 (LA-2666)
LOVELACE FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH, ALBUQUERQUE, N. MEX.
Blast effects in shelters on animals and dummies, 16: 24017 (WT-798)

M

MALLINCKRODT CHEMICAL WORKS. URANIUM DIV., WELDON SPRING, MO.
Production of UO_3, 16: 23773 (MCW-1470)
Urinary U study on plant operators, 16: 23380 (TID-7616(p.99-100))
MARTIN CO., BALTIMORE.
APWRC-GAMICO--modification of GAM-I for PWR, 16: 24945 (MND-C-2500-5)
APWRC-SYBURN--program for burnup calculations, 16: 24944 (MND-C-2500-4)
Code for static and dynamic synthesis of flux and reactivity, 16: 24943 (MND-C-2500-3)
Prog. rpt. on PM-1 nuclear power plant, 16: 24983 (MND-M-1866)
Program and cross-section tape for PWR code, 16: 24094 (MND-C-2500-6)
MARYLAND. UNIV., COLLEGE PARK.
Pionic decays of Σ hyperons, 16: 24675 (AFOSR-2637)
Relativistic quantum mechanics and field theory. II., 16: 24915 (NP-11612(Vol.II))
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Diffusion in Co--Ni alloys, 16: 24169 (NYO-9430)
Forced-convection surface-boiling heat transfer, 16: 23823 (NP-11831)
Nuclear energy levels in P-29*, 16: 24795 (TID-15331)
Prog. rpt. on application of radar to fall-out prediction, 16: 23405 (AD-269884)
Prog. rpt. on joining refractory metals, 16: 24135 (WAL-460.54/1-1)
Prog. rpt. on organic moderator-coolant irradiation loop, 16: 24941 (IDO-

11101)
Solvent extraction of nitrosylruthenium, 16: 23791 (TID-16139)
MATERIALS RESEARCH CORP., ORANGEBURG, N. Y.
Mechanical properties of refractory metals, 16: 24146 (ASD-TDR-62-11)
MECHANICAL TECHNOLOGY INC., LATHAM, N. Y.
Hybrid gas lubricated journal bearing, 16: 23806 (TID-15295)
Self-acting gas journal bearings, 16: 23805 (TID-15212)
MICHIGAN. UNIV., ANN ARBOR.
Elevation of LD_{50} level in *Planaria*, 16: 23414 (TID-15984)
MIDWEST RESEARCH INST., KANSAS CITY, MO.
Ultrasonic propagation in deformed materials, 16: 23971 (ANL-6515(p.121-32))
MINNESOTA. UNIV., MINNEAPOLIS.
Mass and heat transfer rates, 16: 23822 (NP-11818)
MOL, BELGIUM. CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLEAIRE.
Movement of radioactive substances in ground. II., 16: 25046 (TID-7628 (p.155-65))
Movement of radioactive substances in ground. III., 16: 25050 (TID-7628(p.198-210))
MONSANTO RESEARCH CORP. BOSTON LABS., EVERETT, MASS.
Prog. rpt. on organic coolant reclamation, 16: 24940 (IDO-11052)

N

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Solar proton impact zones, 16: 24661 (NASA-TN-D-1291)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, HAMPTON, VA.
Radiation doses in space, 16: 24013 (NASA-TN-D-1267)
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Critical temperature for surface ion currents, 16: 24280 (NASA-TN-D-1307)
NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.
Prog. rpt. on Project Sherwood, 16: 24888 (NBS-7244)
NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Gamma irradiation of fluorocarbon polymers, 16: 23707 (ARL-62-350)
NATIONAL CARBON CO., PARMA, OHIO.
Prog. rpt. on metal carbides, 16: 24798 (WADD-TR-60-143(Pt.III))
NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Depth dose from Pa-234 β rays, 16: 23378 (TID-7616(p.79-88))
Determination of Zr in U materials, 16: 23621 (TID-7629(p.69-80))
Hydrogen in U metal, 16: 23639 (TID-7629(p.316-27))
Measurement of low-surface-area U compounds, 16: 23640 (TID-7629 (p.331-44))
Removal of suspended solids in process wastes, 16: 23385 (TID-7616 (p.223-34))
NATIONAL RESEARCH CORP., CAMBRIDGE, MASS.
Prog. rpt. on thermodynamic properties of Bi-metallic powders, 16: 24139 (AD-269265)
NATIONAL RESEARCH COUNCIL. MATERIALS ADVISORY BOARD.
Prog. rpt. on powder metallurgy, 16: 24110 (MAB-139-M(C4))
Refractory metals sheet rolling, 16: 24160 (MAB-184-M)
Titanium alloy sheet rolling, 16: 24159 (MAB-110-M(15))
NAVAL MATERIAL LAB., BROOKLYN.
Thermal radiation measurements, 16: 23855 (WT-544)
NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Dose from γ rays scattered through Fe and Al, 16: 24906 (USNRDL-TR-558)
Self-radiation oxidation of H-3, 16: 23717 (USNRDL-TR-565)
Stimulation of nervous system with ionizing radiation, 16: 23420 (USNRDL-TR-561)
Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
NAVAL RESEARCH LAB., WASHINGTON, D. C.
Electrode processes survey, 16: 23671 (NRL-5775)
NEW ENGLAND DEACONESS HOSPITAL, BOSTON.
Biological and medical effects of radiation, 16: 23418 (TID-16219)
NEW MEXICO. UNIV., ALBUQUERQUE.
Physiological indices of strain, 16: 23376 (TID-7616(p.61-8))
NEW YORK OPERATIONS OFFICE. HEALTH AND SAFETY LAB., AEC.
Prog. rpt. on fall-out program, 16: 24012 (HASL-127)
NEW ZEALAND. DOMINION X-RAY AND RADIUM LAB., CHRISTCHURCH.
Prog. rpt. on fall-out in New Zealand, 16: 23408 (DXRL-F3)
NORTH CAROLINA. UNIV., CHAPEL HILL.
Electric and magnetic properties, 16: 24142 (AD-270673)
Sorption on clay minerals, 16: 25048 (TID-7628(p.179-86))
NORTHERN STATES POWER CO., MINNEAPOLIS.
Pathfinder safeguards report. II., 16: 24961 (ACNP-5905)
Prog. rpt. on Pathfinder, 16: 24962 (ACNP-62005)
NORWAY. INSTITUTT FOR ATOMENERGI, KJELLER.
Computer applied to reactor burnup studies, 16: 24942 (KR-20)
Corrosion of Al in contact with stainless steel, 16: 24121 (KR-18)
NUCLEAR DEVELOPMENT CORP. OF AMERICA, WHITE PLAINS, N. Y.
Flow tests of BR-2 fuel elements, 16: 24985 (NDA-2561-1)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Nitrogen adsorption-desorption measurements, 16: 23641 (TID-7629(p.36-56))
Program for computing Fermi level in non-metals, 16: 24158 (K-1526)
OAK RIDGE NATIONAL LAB., TENN.
Bearing materials for EGCR, 16: 24170 (ORNL-TM-249)
Bibliography on reactor fuel reprocessing and waste disposal, 16: 23784 (ORNL-2971(Vol.1))
Bibliography on reactor fuel reprocessing and waste disposal, 16: 23785 (ORNL-2971(Vol.3))
Blankets for thermonuclear reactors, 16: 24890 (ORNL-3258)
Burial ground studies, 16: 25065 (TID-7628(p.460-1))
Conference on analytical chemistry, 16: 23613 (TID-7629)
Design for BeO irradiation experiments, 16: 24243 (ORNL-3310)
Determination of minor elements in Be, 16: 23634 (TID-7629(p.245-57))
Determination of oxides and nitrides in salts and metals, 16: 23638 (TID-7629(p.295-307))
Determining particle size distributions of ThO_2, 16: 23775 (ORNL-TM-255)
Effect of seismic vibrations on EGCR, 16: 24986 (ORNL-3224)
Evaluation of U-233 fission yield data, 16: 24792 (ORNL-3305)
Evaluation of ultimate disposal methods, 16: 25072 (TID-7628(p.533-5))
Extraction of Nb-95 from HNO_3 solutions, 16: 23787 (ORNL-3285)
Flame spectrophotometer, 16: 23617 (TID-7629(p.31-41))
Fortran program for single crystal absorption corrections, 16: 24095 (ORNL-TM-229)
Ground disposal of liquid wastes, 16: 25070 (TID-7628(p.506-12))
Head-end treatment of low level wastes, 16: 25036 (ORNL-TM-260)
Heavy water analyzer, 16: 23623 (TID-7629(p.91-109))
In-pile gas-cooled fuel test facility, 16: 24950 (ORNL-TM-250)
In-pile loop for EGCR, 16: 24987 (ORNL-TM-108)
Land burial of solid waste, 16: 25064 (TID-7628(p.437-59))
Mass spectrometer analyzer tube assembly, 16: 23857 (Y-1393)
Movement of Ru in waste-pit system, 16: 25071 (TID-7628(p.513-31))
Processing Th reactor fuels, 16: 23789 (ORNL-TM-241)
Prog. rpt. on Molten Salt Reactor, 16: 25023 (ORNL-3282)
Prog. rpt. on transuranium elements, 16: 23528 (ORNL-3290)
Proton recoil energy loss distribution, 16: 24791 (ORNL-3089)
Publications from ORNL, 1961, 16: 23355 (ORNL-3300(Vol.1))
Purification of Pm-147, 16: 23786 (ORNL-3271)
Reactivity calibrations and fission-rate distribution, 16: 24949 (ORNL-TM-189)
Safety calculations for MSRE, 16: 24988 (ORNL-TM-251)
Scintillation and semiconductor spectroscopy, 16: 23846 (ORNL-TM-137)
Solvent extraction of Nd and Pm, 16: 23788 (ORNL-TM-184)
Solvent extraction of nitrosylruthenium, 16: 23791 (TID-16139)
Storage of high-level packaged solid wastes, 16: 25068 (TID-7628(p.477-90))
Storage of low-level packaged solids, 16: 25067 (TID-7628(p.469-76))
Strontium reactions with minerals, 16: 25049 (TID-7628(p.187-97))
Strontium, Sr-90, and Ca analysis of clams, 16: 23410 (ORNL-TM-270)
Super-prompt-critical behavior of U–Mo assembly, 16: 24674 (ORNL-TM-230)
Symbols for instrument flowsheets and drawings, 16: 23353 (CF-57-2-1 (Rev.1))
Trace element determination in Nb and Zr, 16: 23633 (TID-7629(p.239-

44))
Water requirements for radiochemical processing plant, 16: 23790 (ORNL-TM-244)
OHIO STATE UNIV., COLUMBUS.
Uses of water injection to sub-surface through boreholes, 16: 25000 (TID-7628(p.374-9))
OLIN MATHIESON CHEMICAL CORP., NEW HAVEN.
Melting and casting of UC, 16: 24134 (TID-15337)
OWENS-ILLINOIS GLASS CO., TOLEDO.
High-temperature x-ray diffraction technology, 16: 23837 (ARL-62-315)
Zirconium oxide and boron–silicon refractories, 16: 23599 (ARL-180)

P

P.E.C. CORP., BOULDER, COLO.
Prog. rpt. on a spectrum of ionized O, 16: 24285 (TID-16127)
PARIS. OBSERVATOIRE, MEUDON.
Adiabatic waves in plasma, 16: 24880 (AFCRL-896(Pt.II))
PARIS. UNIVERSITÉ.
Adiabatic waves in plasma, 16: 24880 (AFCRL-896(Pt.II))
Cross sections in neutron photoproduction, 16: 24778 (CEA-2148)
Gold-198 and I-131 in diagnosis of hepatic affections, 16: 23371 (CEA-1994)
High-temperature microscope, 16: 23839 (CEA-2082)
Nuclear excitation by α scattering, 16: 24777 (CEA-2146)
Properties in molten LiCl–KCl, 16: 23675 (HW-tr-40)
Study of $\pi^- + p \rightarrow \pi^0 + n$ and $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ reactions, 16: 24677 (CEA-2136)
Thiazinic and indaminic dye syntheses induced by radiation, 16: 23708 (CEA-1991)
PARSONS (C. A.) AND CO., LTD., NEWCASTLE-UPON-TYNE, ENGLAND.
Uranium alloys containing Mo and C, 16: 24150 (CNEN-113)
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Prog. rpt. on nuclear physics, 16: 24794 (TID-15211)
PERKIN-ELMER CORP., NORWALK, CONN.
Infrared physics, 16: 23973 (ANL-6515(p.163-86))
PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Control rod latch reliability, EGCR, 16: 24982 (IDO-16775)
Dissolution of nuclear fuels. III., 16: 23783 (IDO-14584)
NUFT revision—fast neutron spectrum code for IBM-650, 16: 24092 (IDO-16735)
Precipitation process for Zr fuels. I., 16: 23782 (IDO-14582)
Propane vibrational analysis, 16: 23668 (IDO-16769)
PHILLIPS PETROLEUM CO. RESEARCH DIV., BARTLESVILLE, OKLA.
EOCR experimental projects, 16: 25019 (IDO-16761(p.75-97))
EOCR operations, 16: 25020 (IDO-16761(p.98-105))
Organic coolant research, 16: 25018 (IDO-16761(p.1-74))
Prog. rpt. on organic coolant reactor program, 16: 25017 (IDO-16761)
PICATINNY ARSENAL, DOVER, N. J.
Bibliography on degradation and fracture of plastics, 16: 24112 (PLASTEC-NOTE-2)
PITTSBURGH. UNIV.
Prog. rpt. on alloy formation, 16: 24173 (TID-15819)
PLASMADYNE CORP., SANTA ANA, CALIF.
Magnetohydrodynamic working fluids, 16: 24884 (ASD-TDR-62-259)
POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH. WARSAW.
Interactions of nucleons with heavy nuclei, 16: 24662 (PAN-291/VI)
Radiation yields in two-phase system of O_2(g)–H_2O, NaOH, Na_2SO_3(l), 16: 23716 (PAN-290/ChR)
Radical-initiated chain oxidation of Fe(II), 16: 23715 (PAN-285/ChR)
Separation of Th from molten salts, 16: 23672 (PAN-287/IV)
POWER REACTOR DEVELOPMENT CO., DETROIT.
Prog. rpt. on APDA activities, 16: 24951 (PRDC-TR-55)
PRINCETON UNIV., N. J.
Focusing Cherenkov counters, 16: 24696 (NP-11880)
Measurement of rate for $\mu^- + C^{12} \rightarrow B^{12} + \nu$, 16: 24788 (NP-11796)
PRINCETON UNIV., N. J. PROJECT MATTERHORN.
Broadening of He^+ 4686 line in ion temperature measurements, 16: 24283 (NYO-7885)

R

RADIATION APPLICATIONS INC., LONG ISLAND CITY, N. Y.
Prog. rpt. on large fission product β sources, 16: 24698 (RAI-201)
RAND CORP., SANTA MONICA, CALIF.
Elastic wave calculations for Cowboy, 16: 23804 (RM-3105-AEC)
RIAS. DIV. OF MARTIN CO., BALTIMORE.
Low energy scattering theory, 16: 24912 (AD-270903)
ROCHESTER, N. Y. UNIV.
Lung model, 16: 23383 (TID-7616(p.133-46))
Monte-Carlo calculation of a nuclear cascade, 16: 24697 (NYO-10132)
ROCHESTER, N. Y. UNIV. ATOMIC ENERGY PROJECT.
Antimony-124 chloride in rat following inhalation, 16: 23386 (UR-608)
Late manifestations of body radiation, 16: 23419 (UR-609)
Reaction of uranyl ion with amino acids, 16: 23387 (UR-611)
ROLLS-ROYCE LTD., DERBY, ENGLAND.
Determination of U in waste products, 16: 23637 (TID-7629(p.285-94))

S

SANDIA CORP., ALBUQUERQUE, N. MEX.
Atomic explosion effects on shelters, 16: 24018 (WT-1161)
Evaluation of scintillation systems, 16: 23848 (SCTM-326-61(14))
Neutron flux and spectra measurements in reactor, 16: 23377 (TID-7616 (p.69-77))
Photographic emulsion calibration, 16: 23847 (SCTM-16-62(11))
Proceedings of Sixth Annual Bioassay and Analytical Chemistry Meeting, 16: 23372 (TID-7616)
SANDIA LAB., ALBUQUERQUE, N. MEX.
Laboratory vs. field exposures to PuO, 16: 23381 (TID-7616(p.127-32))
SOUTHWEST RESEARCH INST., SAN ANTONIO.
Cyclic pressure tests of pressure vessels, 16: 23807 (TID-15979)
SPAIN. JUNTA DE ENERGIA NUCLEAR, MADRID.
Analytical control of polyphenylic mixtures, 16: 23603 (JEN-91-DQ/I-25)
STANFORD RESEARCH INST., MENLO PARK, CALIF.
Earth deformation from nuclear detonation in salt, 16: 23357 (PNE-109F)
STANFORD UNIV., CALIF.
Calorimeter for microwave power measurements, 16: 24868 (TID-16053)
Electrodynamic problems of astrophysics, 16: 24656 (ML-879)
SWEDEN. FÖRSVARETS FORSKNINGSANSTALT, STOCKHOLM.
Reversal autoradiography, 16: 23669 (NP-11826)
SYSTEMS RESEARCH LABS., INC., DAYTON, OHIO.
Prog. rpt. on refractory oxides, 16: 24141 (AD-270235)

T

TAPCO. DIV. OF THOMPSON RAMO WOOLDRIDGE INC., CLEVELAND.
Prog. rpt. on coatings for W, 16: 24122 (NP-11700)
Thermal properties of LiH and LiH–Li mixtures, 16: 23670 (NP-11888)
TECHNICAL OPERATIONS, INC., BURLINGTON, MASS.
Radiation hazard from water and milk after nuclear attack, 16: 24014 (NP-11715)
TEXAS. AGRICULTURAL AND MECHANICAL COLL., COLLEGE STATION.
Computer-coupled, automatic activation analysis, 16: 23632 (TID-7629 (p.221-38))
TEXAS. UNIV., AUSTIN.
Crystallographic D-space computer program, 16: 23527 (ANL-6519)
TORONTO. UNIV.
High-speed spark camera, 16: 23852 (UTIA-TN-25)
TRACERLAB, INC., WALTHAM, MASS.
Utilization of radioisotope-excited x rays in fuel analysis, 16: 23622 (TID-7629(p.81-90))

U

UNION CARBIDE NUCLEAR CO. PADUCAH PLANT, KY.
Analysis of Np-237 in human urine, 16: 23375 (TID-7616(p.51-9))
UNION CARBIDE NUCLEAR CO. Y-12 PLANT, OAK RIDGE, TENN.
Direct-reading Be air monitor, 16: 23615 (TID-7629(p.16-21))
Mass spectrometer analyzer tube assembly, 16: 23857 (Y-1393)

Radioactivity distributions in processing Th, 16: 23373 (TID-7616(p.3-38))
Spectrograph for detection of Be, 16: 23614 (TID-7629(p.1-15))

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. DEVELOPMENT AND ENGINEERING GROUP, CAPENHURST, CHES., ENGLAND.
Determination of trace impurities in U compounds, 16: 23636 (TID-7629 (p.276-84))

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. INDUSTRIAL GROUP. CAPENHURST WORKS, CAPENHURST, CHES., ENGLAND.
Spectroscopy for determination of U-235, 16: 23616 (TID-7629(p.22-30))

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. INDUSTRIAL GROUP. WINDSCALE WORKS, SELLAFIELD, CUMB., ENGLAND.
Determination of Ar in CO_2, 16: 23598 (ARDC/P.36)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP. CHEMICAL SERVICES DEPT., CAPENHURST, CHES., ENGLAND.
Determination of U in effluents, 16: 23605 (PG-Report-186)
Determination of U in herbage, 16: 23606 (PG-Report-188)
Determination of U in milk, 16: 23607 (PG-Report-187)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP, SPRINGFIELDS, LANCS, ENGLAND.
Determination of fluoride in U ore concentrates, 16: 23608 (PG-Report-228)
Determination of UO_2F_2 in UF_4, 16: 23609 (PG-Report-323)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP. CHEMICAL SERVICES DEPT., WINDSCALE, SELLAFIELD, ENGLAND.
Determination of O in boiler feed water, 16: 23610 (PG-Report-335)
Determination of hydrazine, 16: 23611 (PG-Report-342)
Determination of TBP with kerosene, 16: 23612 (PG-Report-344)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, DOUNREAY, CAITHNESS, SCOTLAND.
Determination of burnup, 16: 23627 (TID-7629(p.166-76))

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, RISLEY, LANCS, ENGLAND.
Computer program for multigroup diffusion equations, 16: 24763 (TRG-Report-229)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Ground disposal of radioactive wastes, 16: 25075 (TID-7628(p.583-9))

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Determination of burnup, 16: 23626 (TID-7629(p.152-65))
Diffusion of electromagnetic fields, 16: 23834 (AERE-M-1014)
Emission of fission product rare gases from UO_2–BeO and UO_2–ThO_2–BeO, 16: 24144 (AERE-R-4062)
Measurements of Cu(p,n) cross sections, 16: 24793 (TID-12696)
Neutron-scattering studies of liquid diffusion, 16: 24271 (AERE-R-4043)
Thermal conductivity of artificial graphites, 16: 24143 (AERE-R-3973)
Variation of $\eta/\bar{\nu}$ for U-235, 16: 24790 (NRDC-123)
Zeeman effect of arc and spark spectra of Y and Th, 16: 24270 (AERE-R-4029)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. CHEMISTRY DIV., WOOLWICH OUTSTATION, ENGLAND.
Barium in bones and foodstuffs, 16: 23370 (AERE-R-4035)
Determination of As in steels, 16: 23597 (AERE-R-3974)
Isolation of micro quantities of U, 16: 23596 (AERE-R-3499)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. CULHAM LAB., CULHAM, ABINGDON, BERKS, ENGLAND.
Design of shock tube, 16: 24275 (CLM-R-18)
Reversed field heating in thetatron, 16: 24886 (CLM-R-19)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. WANTAGE RESEARCH LAB., WANTAGE, BERKS, ENGLAND.
Radiation process for inhibition of sprouting in potatoes, 16: 23411 (AERE-R-3977)
Soil moisture and density by nuclear methods, 16: 23982 (AERE-Bib-140)

UNITED NUCLEAR CORP. DEVELOPMENT DIV., WHITE PLAINS, N. Y.
Fast neutron cross sections, 16: 24796 (UNC-5002)

UNITED NUCLEAR CORP. FUELS DIV., NEW HAVEN.
Prog. rpt. on nuclear fuel research, 16: 24168 (NYO-2694)

UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Prog. rpt. on sintered UO_2, 16: 24097 (EURAEC-57)
Prog. rpt. on Zr alloys, 16: 24117 (ARF-2198-28)
Wet steam cooling experiments, 16: 23816 (EURAEC-42)

UPPSALA UNIV.
Rational approximation of decay-type functions, 16: 24086 (ARL-229)

V

VANDERBILT UNIV., NASHVILLE.
Construction of neutron long counter, 16: 23849 (TID-15746)
Ranger study of Po–Be neutron spectrum, 16: 24762 (TID-15743)

VARIAN ASSOCIATES, PALO ALTO, CALIF.
Linear accelerators for high-energy x-ray production, 16: 23976 (ANL-6515(p.218-47))
Rocket-borne magnetometer, 16: 23836 (AFSWC-TDR-62-25)

VIRGINIA. UNIV., CHARLOTTESVILLE.
Techniques for study of metals at elevated temperatures, 16: 24166 (NP-11854)

VITRO CORP. OF AMERICA, NEW YORK.
Shelter instrumentation, 16: 23856 (WT-790)

W

WASHINGTON UNIV., ST. LOUIS.
Prog. rpt. on cosmic radiation, 16: 24660 (AROD-2774:2)

WASHINGTON. UNIV., SEATTLE.
Decontamination of PWR systems, 16: 24939 (HW-SA-2548)

WEATHER BUREAU, OAK RIDGE, TENN.
Graphs for atmospheric dispersion, 16: 23986 (ORO-545)

WESTINGHOUSE ELECTRIC CORP., CHESWICK, PENNA.
Sodium flow controller, 16: 24952 (TID-15913)

WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DIV., PITTSBURGH.
CVTR controlled plant study, 16: 24972 (CVNA-138)
Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)

WESTINGHOUSE ELECTRIC CORP. BETTIS ATOMIC POWER LAB., PITTSBURGH.
Control rod withdrawal transients for PWR, 16: 25000 (WAPD-PWR-TE-99)
Effective U-238 resonance capture integrals, 16: 24764 (WAPD-T-1497)
Penetration of γ rays through slab shields, 16: 24907 (WAPD-T-1464)
Prog. rpt. on PWR project, 16: 24998 (WAPD-MRP-97)
Reactor pressure drop and coolant flow in PWR, 16: 24999 (WAPD-PWR-TE-98)
Steam generator blowdown rate, 16: 25001 (WAPD-PWR-TE-118)

WESTINGHOUSE ELECTRIC CORP. RESEARCH LABS., PITTSBURGH.
Induced conductivity targets in camera tubes, 16: 23853 (WADD-TN-60-307)
Ratio of diffusion coefficient to mobility coefficient for electrons, 16: 24281 (NP-11846)

WORCESTER FOUNDATION FOR EXPERIMENTAL BIOLOGY, SHREWSBURY, MASS.
Effects of x radiation on ova, 16: 23416 (TID-16121)

WRIGHT AIR DEVELOPMENT CENTER. AERONAUTICAL RESEARCH
Effective fast neutron removal cross section, 16: 24797 (WADC-TR-58-266)

Y

YALE UNIV., NEW HAVEN.
Prog. rpt. on anti-radiation agents, 16: 23515 (AD-269983)

PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

Æ becomes	ae
ð	oe
ø	oe
ü	ue (except in transliterated Chinese names)

A

ABDULLIN, G. Z., Radiosensitivity of brain, 16: 23421 (AEC-tr-5141)

ABE, Kunio, Wear in shearing process by irradiated tools, 16: 24068

ABECASIS, F. M., Sand and silt movement research, 16: 24005

ABECASIS, S., Tellurium-121 isomeric pairs in Sb-121(d,2n) reaction, 16: 24786 (NP-11791)

ABERNATHY, Frederick H., Instabilities in reflected slab reactor, 16: 24524

ABKIN, A. D., Carbanionic mechanism of polymerization under γ rays, 16: 23758

ABKIN, A. D., Copolymerization of acrylonitrile and ethylene by radiation, 16: 23762

ABKIN, A. D., Mechanisms of γ-induced polymerization, 16: 23545

ABKIN, A. D., Mechanism of polymerization by radiation. I., 16: 23760

ACCARY, A., Mechanism of reaction hot pressing, 16: 24136

ACKERMAN, M., Mass spectrometric study of B–C, 16: 24177 (WADD-TR-60-782(Pt.VIII))

ACKLEY, R. D., Characterization of gas-borne radioactive materials, 16: 24648

ADAMIK, Emil R., Lymphopenia produced by irradiation, 16: 23434 (BNL-611)

ADAMS, J. S., Prog. rpt. on organic coolant reclamation, 16: 24940 (IDO-13052)

ADAMS, J. S., Reclamation of organic nuclear reactor coolant, 16: 24462

ADAMS, M. A., Mechanical properties of refractory metals, 16: 24146 (ASD-TDR-62-11)

ADAMS, R. K., Symbols for instrument flowsheets and drawings, 16: 23353 (CF-57-2-1(Rev.1))

ADAMS, Robert E., Removal of radioiodine from gases, 16: 24649

ADAMS, Roger James, Isotopic exchange of chloride ligands, 16: 23681

ADELSTEIN, S. J., Radioprotective effect of mitochondrial matrix, 16: 23456

ADLER, D. Bonaccini, Cross sections for fissile elements, 16: 24386

ADLER, F. T., Cross sections for fissile elements, 16: 24386

AGARWAL, B. K., Capture rates of μ^- by nuclei, 16: 24826

AGARWALA, R. P., Diffusion in Co–Ni alloys, 16: 24169 (NYO-9430)

AGLINTSEV, K. K., Protection against x and γ rays, 16: 24034

AGODI, A., Nuclear reaction cross sections, 16: 24845

AIDA, Gensaku, Improvement of dyeing properties of fibers by γ irradiation, 16: 24265

AIKIN, A. M., Fouling of heat transfer surfaces by organic coolants, 16: 24459

ALAM, M. N., Measurement of spectral density of reactor power fluctuations, 16: 24549

ALBER, R. A., Scintillation counters for space radiation, 16: 23927

ALBERTI, Giulio, Chromatography of inorganic ions on Zr phosphate paper, 16: 23650

ALEKSANDROV, A. P., Problems of nuclear energetics, 16: 25012

ALEKSEEV, V. A., Angular distribution of secondary electrons, 16: 24335

ALEXANDER, Mary L., Radiation damage in *Drosophila virilis*, 16: 23470

ALEXANDER, R., Properties of n^+-i-p^+ semiconductor detector, 16: 23896

ALIMARIN, I. P., Gravimetric determination of Zr, 16: 23660

ALLARD, Albert H., Latent image, 16: 23967 (ANL-6515(p.81-6))

ALLAS, Richard Georg Ivar, Polarization of protons in $C^{13}(d,p)C^{14}$ and $Be^9(d,p)Be^{10}$, 16: 24816

ALLEN, L., Zeeman effect of arc and spark spectra of Y and Tm, 16: 24270 (AERE-R-4029)

ALLEN, R. D., Properties of W, Ta, and Mo, 16: 24162 (NP-11654)

ALLIS, W. P., Orbit models for a plasma, 16: 24892

ALLKOFER, O. C., Outer surface contamination of jet planes, 16: 24022

ALMASSY, Gyula, Analysis of U, Th, and Zr, 16: 23653

ALMASY, Andor, Radiochemical lab. at Veszprem, Hungary, 16: 23726 (JPRS-14324)

ALMENAS, K., Startup transients in boiling water reactors, 16: 24530

ALPATOV, W. W., Influence of drugs upon blood serum toxicity acquired under radiation, 16: 23440

ALT, David, Isotope geochemistry of B, 16: 23537

ALVAEGER, T., Mass number assignments and γ spectra of Sn and Sb isotopes, 16: 24805

ALVAREZ, Luis W., SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)

AMANO, Keishi, Browning of irradiated fish. I., 16: 24071

AMANO, Keishi, Effects of γ irradiation on fish, 16: 24070

AMAVIS, R., Discharge of radioactive wastes in Inpra, 16: 25074 (TID-7628(p.569-82))

AMBROSINO, G., Reaction $Si^{28}(n,\alpha)Mg^{25}$, 16: 24846

AMENIYA, Hisao, Studies on 6-nylon fibers irradiated by γ rays. I., 16: 24264

AMIS, Edward S., Exchange reactions in mixed solvents, 16: 23572

AMSTER, Harvey J., Spatial distribution of resonance absorptions, 16: 24392

ANDERSEN, S. L., Proton bombardment of Al, 16: 24848

ANDERSON, C. H., Scaling of superheater tube alloys, 16: 24125

ANDERSON, Carl A., Jr., Measurement of neutron energy spectra with MIT fast chopper, 16: 24369

ANDERSON, E. C., Lunar composition by scintillation spectroscopy, 16: 23930

ANDERSON, E. E., Steady-state release of Kr and Xe fission products, 16: 24628

ANDERSON, Gordon F., Electrical conductivity of high-temperature gases,

16: 24282 (NP-11906)
ANDERSSON, Bengt, Local irradiation of central nervous system with high-energy protons, 16: 23489
ANDREEVA, A. B., Effects of Fe_2O_3 on Zr sintering, 16: 24203
ANDREEVA, O. I., Study of C isotope exchange reactions, 16: 23558
ANDRIANKIN, E. I., Electric current during the flow of plasma, 16: 24902
ANTHONY, Andrew J., Thermal testing of UO_2 fuel elements, 16: 24620
ANTONOV, A. V., Diffusion and thermalization of neutrons in water and ice, 16: 24765 (AEC-tr-5143)
ANTONY, K. C., Investigation of B_4C–Ni electro dispersions, 16: 24107 (GEAP-3831)
APPEL, Klaus, Rational approximation of decay-type functions, 16: 24086 (ARL-229)
APPLEBY, Liz, Properties in molten LiCl–KCl, 16: 23675 (HW-tr-40)
ARIPOV, R. A., On charge exchange of π^- mesons, 16: 24685 (JINR-P-928)
ARLIN, Z. E., Deep well disposal of U tailing water, 16: 25058 (TID-7628 (p.356-67))
ARMENOFF, C. T., Piqua core development and fabrication, 16: 24465
ARMSTRONG, D. A., Hydrogen formation in γ-irradiated HCl, 16: 23731
ARNESON, S. O., Development of APM-clad UO_2 fuel elements, 16: 24463
ARNOLD, E. D., Production of transuranium elements, 16: 24340
ARNOLD, William J., Behavioral effects of cranial irradiation, 16: 23509
ARNS, R. G., Decay of Nb-94 and Nb-94m, 16: 24837
ASPILA, K., Examination of irradiated SAP clad UO_2 fuel element, 16: 24235 (CRFD-1084)
ASTAUROV, B. L., Ionizing radiations and heredity, 16: 23461
ATEN, A. H. W., Jr., Sulfur atoms in reactions, 16: 23574
AUBRY, B., Uranium oxide sintering furnace, 16: 24100 (EURAEC-57 (App.3))
AUKERMAN, Lee W., Radiation damage in compound semiconductors, 16: 24234 (ARL-62-343)
AUSTIN, George, Effects of radiation on spinal neurons, 16: 23502
AUSTIN, Pauline M., Prog. rpt. on application of radar to fall-out prediction, 16: 23405 (AD-269884)
AVDULOV, G. I., Isotope effect in H exchange reactions, 16: 23569
AVERBACH, B. L., Diffusion in Co–Ni alloys, 16: 24169 (NYO-9430)
AVERY, R., CYCLE and COST—codes for fast reactor fuel cycle analysis, 16: 24437
AVERY, R., Fuel cycle studies, 16: 24484
AVERY, R., Measurements in fast assemblies at Argonne, 16: 24357
AVRAHAMI, Menashe, Adsorption at ionized surface layers, 16: 23585
AWATANI, John, Effects of γ radiation on polyethylene, 16: 24259
AXTMANN, R. C., Formation of NO_2 in liquid air by fast neutrons, 16: 24587
AYKHODZHAEV, B. I., Modification of cellulose by grafting, 16: 23544
AYLWARD, J. R., Dissolution of nuclear fuels. III., 16: 23783 (IDO-14584)
AZIZOV, U., Modification of cellulose by grafting, 16: 23544

B

BABESHKIN, A. M., Separation of natural radioisotopes, 16: 23990 (AEC-tr-5159)
BABMINDRA, V. P., Degeneration and regeneration of synapses after radiation, 16: 23442
BACHOFER, C. S., Radiation effects on nerves, 16: 23503
BACK, R. A., Gamma-radiolysis of gases, 16: 23730
BACKSTROM, J. E., Concrete made with barite aggregates, 16: 24229
BAETSLE, L., Movement of radioactive substances in ground. II., 16: 25046 (TID-7628(p.155-65))
BAETSLE, L., Movement of radioactive substances in ground. III., 16: 25050 (TID-7628(p.198-210))
BAGGE, E., Outer surface contamination of jet planes, 16: 24022
BAGLEY, R. O., Prog. rpt. on PM-1 nuclear power plant, 16: 24983 (MND-M-1866)
BAIERLEIN, Ralph F., Three-dimensional geometry, 16: 24326
BAILEY, C. E., Power limiting and shutdown mechanisms in D_2O reactor, 16: 24516
BAILEY, Orville T., Radiation of central nervous system, 16: 23480
BAILEY, Thomas W., Electrostatic shielding of high-energy protons, 16: 24903 (ASD-TDR-62-244)
BAILEY, W. J., Irradiation testing of Pu fuel element at Hanford, 16: 24640
BAILIE, R. C., Thorium canning methods, 16: 24133 (RFP-268)
BAK, George, Preparation of O^{18}-labeled furan, 16: 23530
BAKER, Charles P., Lesions in cerebral cortex by deuteron irradiation, 16: 23490
BAKER, P. S., Recovery of irradiated U by extraction procedure, 16: 24607
BAKER, S. I., Response of NaI(Tl) to radiation, 16: 23879
BALABANOVA, L. A., Plasmon spectra in In and InSb, 16: 24329
BALANDIN, A. A., Mechanism of catalytic processes, 16: 23568
BALARIN, M., Focusing conditions for atomic collisions in graphite, 16: 24206
BALASOV, E. Ya., Automation in pulp and paper industry, 16: 24077
BALAYRE, Gerard, Radioactivity and control in petroleum industry, 16: 24057
BALDIN, A. M., Hypercharge and degeneracy in respect to isotopic spin, 16: 24681 (JINR-D-976)
BALESTIC, Serge, Thiazinic and indaniaic dye syntheses induced by radiation, 16: 23708 (CEA-1991)
BALL, G. L., Scattering resonances and reactor calculations, 16: 24387
BALL, R. M., Noise analysis to measure reactor stability, 16: 24539
BALLI, D., Neutron cross sections of Au, Se, Sb, and Te, 16: 24811
BANERJEE, H., Conservation of the axial vector current, 16: 24728
BANET, L., Thermal radiation measurements, 16: 23855 (WT-544)
BANHAM, M. F., Determination of burnup, 16: 23626 (TID-7629(p.153-65))
BANNERMAN, Daniel E., Nearly-4π liquid scintillation counter, 16: 23921
BARABOI (BARABOY), V. A., Polarographic activity of proteins during radiation sickness, 16: 23516 (JPRS-13639)
BARANGER, M., Symmetry properties of S matrix, 16: 24916 (NP-11738)
BARASHENKOV, V. S., Production of deuterons, 16: 24343
BARBIER, M., Design of fast-response photomultiplier, 16: 23864
BARDON, Marcel, Mott scattering of polarized muons, 16: 24747
BARGER, A. C., Myocardial blood flow determined with Kr-85, 16: 23363
BARKALOV, I. M., Obtaining sulfur-labeled compounds, 16: 23550
BARKALOV, I. M., Radiation polymerization of phenylacetylene, 16: 23797
BARKANOV, I. M., Effect of radiation on Teflon and other polymers, 16: 23720 (AEC-tr-5144)
BARKER, R. E., Jr., Diffusion in polymers, 16: 24195
BARKER, S. A., Synthesis of methyl 3-O-α-d-glucopyranosyl-C^{14}-β-d-xylopyranoside, 16: 23556
BARLOW, John S., Geographic distribution of multiple sclerosis, 16: 23479
BARMIN, V. V., Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)
BARNABY, C. F., Large area liquid scintillation and Cherenkov counters, 16: 23937
BARNES, R. H., Xenon release from recoil-damaged Al_2O_3, 16: 24619
BARONI, E. E., Polystyrene damage by radiation, 16: 23761
BARODDY, Eugene M., Radiation damage in compound semiconductors, 16: 24234 (ARL-62-343)
BARSS, W. M., Computer study of reactor fueling, 16: 24932 (CRRP-1087)
BARTH, Karl, Radiological K determination in glasses, 16: 23656
BARTKE, J., Hyperon and kaon production, 16: 24737
BARTON, C. J., Blankets for thermonuclear reactors, 16: 24890 (ORNL-3258)
BARTON, J. C., Large area liquid scintillation and Cherenkov counters, 16: 23937
BARUT, Asim O., Virtual particles, 16: 24752 (UCRL-9993)
BASHANDY, E., Decay of Hf-175, 16: 24806
BASHANDY, E., Decay of Hf-181, 16: 24807
BASHANDY, Ekbal, Decay of Yb-175, 16: 24808
BASTL, Werner, Instrumentation of reactors, 16: 24957
BASU, B., Decay of Sb-113, 16: 24832
BATA, Lajos, Moderating parameters of "Dowtherm A", 16: 24774
BATCH, J. M., Boiling heat transfer and burnout correlations, 16: 23817 (HW-71684)
BATCH, M. L., Noise analysis to measure reactor stability, 16: 24539
BATE, L. C., Determination of minor elements in Be, 16: 23634 (TID-7629(p.245-57))
BATE, L. C., Determining particle size distributions of ThO_2, 16: 23775 (ORNL-TM-255)
BATE, L. C., Trace element determination in Nb and Zr, 16: 23633 (TID-7629(p.239-44))
BATES, J. L., Irradiation of UO_2 single crystal, 16: 24608
BATTER, John, Gamma scattering by nearby surfaces, 16: 24604

BAUER, A. A., Evaluation of Th and Th–U compounds, 16: 24630

BAUER, A. A., Niobium–U alloys for elevated temperature, 16: 24633

BAUER, S. H., Condensation behind normal shocks, 16: 24889 (NP-11601)

BAUMANN, Norman P., Neutron diffusion coefficient in D_2O, 16: 24374

BAYBARZ, R. D., Separation of transuranium elements from rare earths, 16: 24344

BAYBARZ, R. D., Separation of transuranium elements by phosphonate extraction, 16: 24345

BEAK, V., Spark discharge in atmospheres of Ar and Xe, 16: 24289 (NP-tr-[illegible])

BEAL, R. J., Radiation hazards at Chalk River, 16: 24009 (CRRIS-1071)

BEAN, C. H., Fabrication of small-diameter Zr alloy tubing, 16: 24634

BEAN, C. H., Vacuum brazing of superheater fuel plates, 16: 24635

BEAUMEVIEILLE, H., Alpha spectrometry using junction detectors, 16: 23840 (CEA-2138)

BEBEL, D., Range-energy relation in AGFA-K2 emulsions, 16: 23859 (CEA-tr-A-1119)

BECK, Stephen D., Matrix failure in dispersion fuel plates, 16: 24612

BECKER, E., Agfa-Texo-F film in testing with γ rays, 16: 23977

BECKER, K., Dose-measuring film evaluation, 16: 23869

BECKER, Manfred, Fuel elements for power reactors, 16: 24113

BECKJORD, E. S., Scheduling computer system for Big Rock Point Plant, 16: 24545

BEER, R., Isotope shifts and hyperfine structure, 16: 24336

BEGHIAN, L. E., Investigation of subcritical assemblies by pulsed neutron source technique, 16: 24424

BEHAR, Albert, Changes in brain caused by α particles, 16: 23492

BELANGER, Leonard F., Radioactive sulfate uptake in chick stomach, 16: 23401

BELITZ, Hans-Joachim, Methane-filled spark counter, 16: 23867

BELOT, Y., Effect of column length on Sr-90 removal, 16: 25051 (TID-7628(p.211-13))

BELTER, Walter G., Ground disposal program 1951-61, 16: 25040 (TID-7628(p.12-16))

BELTER, Walter G., Radioactive waste burial sites, 16: 25063 (TID-7628 (p.425-36))

BENENT, A. L., Environmental testing of reactor materials, 16: 24239 (IN-SA-2547)

BENEDICT, M., Extraction of H_2O and HNO_3 by TBP–hexane, 16: 24646

BENES, Jaroslav, Gamma film dosimetry, 16: 24028

BENESOVSKY, F., Studies of U–Th–C system, 16: 24180 (AEC-tr-5175)

BENJAMIN, B. M., Radiochemistry of deamination reactions, 16: 23564

BENNET, Leonard L., Fuel values of Pu and U-233, 16: 24483

BENNETT, E. F., Noise measurements on reactor servo-control system, 16: 24551

BENNETT, F. D., Shock waves from exploding wires, 16: 24273 (BRL-1332)

BENNETT, Leslie R., Effects of head irradiation in newborn rats, 16: 23475

BENNETT, Walter P., Geome temperature and radiation studies, 16: 23356 (PNE-106P)

BENSEN, D. W., Hanford studies in geochemistry, 16: 25052 (TID-7628 (p.214-36))

BENSEN, D. W., Mineral adsorption of radionuclides, 16: 25035 (HW-[illegible])

BENSON, P. R., Subcooled nucleate boiling in Santowax R, 16: 23820 (AAA-SR-6291)

BENSON, Royal H., Liquid scintillation counting of H-3, 16: 24578

BERARD, Michael F., Bibliography on diffusion in ceramic systems, 16: 24157 (IS-448)

BERGER, A., Surface pasteurization by soft x rays, 16: 24036 (AEC-tr-[illegible])

BERGER, Harold, Neutron radiography, 16: 23965 (ANL-6515(p.28-52))

BERGLES, Arthur E., Forced-convection surface-boiling heat transfer, 16: 23823 (NP-11831)

BERGSTRAND, Patricia J., Osteosarcomas studied by serial roentgenography, 16: 23464

BERGSTROM, R. H., Containment vessel studies for HTGR, 16: 24489

BERKOWITZ, L., Wet steam cooling experiments, 16: 23816 (EURAEC-42)

BERMAN, Philip G., Triga dosimetry. I., 16: 25016 (DOFL-TM-60-27)

BERMAN, R. M., Irradiation behavior of ZrO_2–UO_2 fuels, 16: 24616

BERNSTEIN, R. B., Vapor pressure of SO, and SO_2^+, 16: 23693

BERSHTEIN (BERSHTEYN), S. A., Polarographic activity of proteins during radiation sickness, 16: 23516 (JPRS-13639)

BERSIN, Richard L., Application of radioactive clathrates to gas monitoring, 16: 24576

BERTHOLD, Oscar A., Electric propulsion research, 16: 25030 (AFOSR-1632)

BERTOLETTI, S., Wet steam cooling experiments, 16: 23816 (EURAEC-42)

BETEKHTIN, V. I., Disorientation of mosaic blocks by x-ray scattering, 16: 24330

BEVER, M. B., Liquid metal solution calorimeter, 16: 23949

BEWICK, J. A., Synthesis approximations in time direction, 16: 24543

BEYER, Norman S., Color radiography, 16: 23975 (ANL-6515(p.203-17))

BEYSTER, J. R., Low-energy neutron spectra in D_2O and H_2O, 16: 24366

BEZLER, P., Brookhaven chemonuclear in-pile test loop, 16: 24586

BHAT, Mulki Radhakrishna, Radioactivity of Tb-158 and Tb-157, 16: 24814

BIANCHI, L., Three-body Green's function for S-states, 16: 24733

BIBERGAL, A. V., Protection against x and γ rays, 16: 24034

BICKEL, Paul A., Reactor pressure drop and coolant flow in PWR, 16: 24999 (WAPD-PWR-TE-98)

BICKER, Arden E., Effect on neutrons and x rays on grasshopper embryos, 16: 23413 (TID-15962)

BIGGS, Max W., Urinalysis for Cm, 16: 23374 (TID-7616(p.39-50))

BILLS, C. W., Nuclear and mechanical effects in SL-1 incident, 16: 24514

BILLS, C. W., SL-1 recovery operation, 16: 24511

BINNS, Ian M., Concentric tubular reactor fuel elements, 16: 24929 (AAEC/E-89)

BIRKHOFER, Adolf, Safety in nuclear installations, 16: 25010

BIRKHOFF, Garrett, Computation of reactor thermal transients, 16: 24442

BIRYUK, E. A., Determination of Sc, 16: 23657

BISKIS, Birute O., Osteosarcomas studied by serial roentgenography, 16: 23464

BISWAS, S. N., Magnetic moments of baryons, 16: 24739

BISWAS, S. N., Resonances (π-σ) and (K-σ), 16: 24734

BJAERNGARD, Bengt, Spectra of scattered radiation behind slabs of water, 16: 24293

BJERKE, Arthur E., Time resolution of counter system, 16: 23915 (UCRL-9976)

BLACKSTONE, James O., Jr., Portable β-γ survey meter, 16: 24011 (DP-711)

BLACKWELL, L. H., Effect of x radiation on plasma Fe, 16: 23430

BLAKE, J. Bernard, Transverse polarization of internal conversion electrons, 16: 24784 (NP-11622)

BLAKE, Martin I., Carbon dioxide uptake in algae, 16: 23364

BLAMEY, J. W., Large homopolar generator, 16: 24877

BLANC, D., Reaction $Si^{28}(n,\alpha)Mg^{25}$, 16: 24846

BLANK, G. R., Determination of Zr in U materials, 16: 23621 (TID-7629 (p.69-80))

BLANK, G. R., Determination of Zr in U, 16: 23655

BLANKENSHIP, J. L., Making p^+-i-n^+ diode detectors, 16: 23900

BLATT, John M., Bose-Einstein condensation of excitons, 16: 24320

BLECHINGER, F. K., Beta quenched Zr–Nb alloy, 16: 24137

BLEIBERG, M. L., Irradiation behavior of ZrO_2–UO_2 fuels, 16: 24616

BLESSING, W. G., Neutron filter for irradiation testing of fuel elements, 16: 24641

BLEY, W. H., Heat transfer of irradiated Santowax OMP, 16: 24456

BLEY, W. H., In-pile irradiation of Santowax OMP, 16: 24455

BLEY, W. H., Prog. rpt. on organic moderator-coolant irradiation loop, 16: 24941 (IDO-11101)

BLINC, Marta, Application of γ radiation in food industry, 16: 24061

BLINC, Marta, Effects of radiation on food products, 16: 24044

BLOCK, M. M., Beta decay of negative muon, 16: 24725

BLOKHINTSEV, D. I., Elastic pion and nucleon scattering, 16: 24721

BLOMEKE, J. O., Evaluation of ultimate disposal methods, 16: 25072 (TID-7628(p.532-5))

BLOUNT, E. I., Bloch electrons in a magnetic field, 16: 24318

BLOXAM, T. W., Determination of U and Th in rocks, 16: 23651

BLUE, Edwin, Diffusion of charged particles in scattering medium, 16: 24676 (APED-3960)

BLUE, Edwin, Diffusion of electrons in neutral gas, 16: 24272 (APED-3999)

BLUE, J. W., Scintillation response of alkali iodides, 16: 23883
BLUM, L., Evolution equation for the homogeneous crystal, 16: 24314
BOATO, G., Vapor pressure of isotopic solids, 16: 24311
BOBACK, M. W., Removal of suspended solids in process wastes, 16: 23385 (TID-7616(p.223-34))
BOBETH, Wolfgang, Modification of fibers by radiation. I., 16: 24249
BOBETH, Wolfgang, Modification of fibers by radiation. II., 16: 24250
BOER, K. W., Bose-Einstein condensation of excitons, 16: 24320
BOEGLY, W. J., Jr., Storage of high-level packaged solid wastes, 16: 25068 (TID-7628(p.477-90))
BOEMMEL, H. E., Generation of uhf sound waves in solids, 16: 23970 (ANL-6515(p.117-20))
BOGART, Donald, Neutrons from Be(α,n) sources and Be(n,2n) reactions, 16: 24388
BOHM, G. J., Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)
BOLAND, J. F., Sensitivity of pressure transducers, 16: 24554
BOLEF, D. I., Ultrasonic cw spectrometer, 16: 23950
BOLLINGER, L. M., Ratio of symmetric to asymmetric fission for U-235, 16: 24347
BONAZZOLA, G., Photodisintegration of S, 16: 24842
BOND, V. P., Changes in bone marrow following body irradiation, 16: 23429 (BNL-5032)
BONDARENKO, I. I., Energy of fission products from U-235, 16: 24809
BONNER, T. W., Neutrons from reaction $Be^9(\alpha,n)C^{12}$, 16: 24852
BONNET, J., Magnetic amplifier in reactor instrumentation, 16: 23861 (CEA-tr-A-1126)
BOOT, S. J., Neutron dose in phantom, 16: 23460
BORCHERS, Robert Reece, Study of Li(p,n) reaction, 16: 24817
BORELLO, O., Photodisintegration of S, 16: 24842
BORGE, Orville E., Concrete made with hydrous-Fe aggregates, 16: 24227
BORISENKO, L. F., Scandium, 16: 24000
BORISOV, E. A., Isotope effect of Br recoil atoms in (n,γ) process, 16: 23723 (AEC-tr-5151)
BORISOV, V. L., Angular distribution of secondary electrons, 16: 24335
BORKOWSKI, C. J., Making p^+-i-n^+ diode detectors, 16: 23900
BOROUGHS, Howard, Radiation research at a tropical center, 16: 23427
BOROWITZ, J. L., Volatilities of H_2O^{17}/H_2O^{18}, 16: 23667 (IA-728)
BORY, L., Range-energy relation in AGFA-K2 emulsions, 16: 23859 (CEA-tr-A-1119)
BOTHE, H.-K., Ionization detector for gas chromatography, 16: 23932
BOTTENHOFER, A., Underground personnel shelters, 16: 24020 (WT-1454)
BOTTINO, A., Potential scattering for complex energy, 16: 24310
BOVEY, L., Isotope shifts and hyperfine structure, 16: 24336
BOWEN, T., Scintillation counter K^+ bubble chamber, 16: 23919
BOWERS, V. A., ESR of alkali atoms in inert-gas matrices, 16: 23702
BOWMAN, Charles Daniel, Neutron resonances in intermediate nuclei, 16: 24818
BOXALL, D. G., Mechanical properties of Al alloys, 16: 24171 (R61CAP69)
BOYD, W. K., Corrosion analysis of VPP components, 16: 24118 (BMI-X-201)
BOZOKY, Laszlo, Current efficiency in aluminum furnaces, 16: 23812
BRAAMS, R., Effect of radiation on albumen, 16: 23433
BRADSHAW, R. L., Evaluation of ultimate disposal methods, 16: 25072 (TID-7628(p.532-5))
BRADSHAW, R. L., Storage of high-level packaged solid wastes, 16: 25068 (TID-7628(p.477-90))
BRADY, M. Michael, Calorimeter for microwave power measurements, 16: 24868 (TID-16053)
BRAMBLETT, R. L., Neutrons from reaction $Be^9(\alpha,n)C^{12}$, 16: 24852
BRAMEN, R. S., Instrument for monitoring air-borne Be, 16: 24571
BRANDELA, M., Resistance to thermal shock, 16: 24103 (EURAEC-57 (App.6))
BRANDT, Werner, Bose-Einstein condensation of excitons, 16: 24320
BRANK, J., Application of γ radiation in food industry, 16: 24061
BRANSDEN, B. H., Low energy scattering theory, 16: 24912 (AD-270903)
BRANSDEN, B. H., Pion-pion scattering, 16: 24723
BRAVERMAN, I. B., Reduction of U oxides and UO_2F_2, 16: 24187
BREDOV, M. M., Plasmon spectra in In and InSb, 16: 24329
BREGADZE, Yu. I., Production of pure fast-neutron fluxes, 16: 24705
BREHM, R. L., Temperature coefficients in ZrH moderated reactors. I., 16: 24380
BREHM, R. L., Temperature coefficients in ZrH moderated reactors. II., 16: 24381
BREIT, A., X-irradiated central nervous system of hamster, 16: 23485
BRENNER, M. W., Nuclear energy levels in $P-29^+$, 16: 24795 (TID-15331)
BRENTON, R. F., Power calibration of Susie reactor, 16: 24933 (DC-60-6-722)
BREWER, Jerome, Thermodynamic data on O and N, 16: 23664 (ASD-TR-61-625)
BRICKLEY, S. G., Platinum–Mo alloys, 16: 24185 (AERE-Trans-884)
BRIDGWATER, J., Formation of NO_3 in liquid air by fast neutrons, 16: 24587
BRIGHT, Norman F. H., Binary system CaO–Nb_2O_5, 16: 24191
BRISBOIS, J., Determination of flux/ev with Au foil detectors, 16: 23841 (CEA-2162)
BRITT, H. C., Energetics of fission reactions, 16: 24350
BRITTON, W. H., Pyrolytic carbon coating of ceramic fuel, 16: 24626
BRIZZEE, K. R., Effects of fetal x irradiation in cerebral cortex, 16: 23473
BROADBANK, R. W. C., Exchange reactions in aromatic systems, 16: 23562
BROCK, J. E., Corrosion effects on heat transfer through tubes, 16: 24127
BROIDO, A., Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
BROMLEY, D. A., Experimentation with semiconductor detectors, 16: 23895
BROOKS, F. D., Variation of η/ν for U-235, 15: 24790 (NRDC-123)
BROOKS, H., Generalized variational method, 16: 24372
BROOKS, Robert D., Reactor control, 16: 24960
BROOKS, W. L., Iso Measurements of UO_2–D_2O lattices, 16: 24427
BROUSAIDES, Frederick J., Application of radioactive clathrates to gas monitoring, 16: 24576
BROWN, D. H., Machinery systems and control, 16: 24963 (AD-269402)
BROWN, Daniel G., Acute central nervous system syndrome of burns, 16: 23498
BROWN, I., Determining limestone and schist, 16: 23996
BROWN, P. S., Flux distributions in U–D_2O lattices, 16: 24430
BROWN, Randall E., Geohydrologic features affecting waste disposal, 16: 25042 (TID-7628(p.77-98))
BROWN, Robert J. S., Reducing remnant magnetic fields in nuclear well logging, 16: 23961
BROWN, W. Lyon, Effects of radiation on psychologic processes, 16: 23514
BROWNE, Frederick L., Concrete made with Fe aggregate, 16: 24226
BROWNELL, Gordon L., Therapeutic value of isotopes, 16: 24561
BROWNING, W. E., Jr., Characterization of gas-borne radioactive materials, 16: 24648
BROWNING, W. E., Jr., In-pile melting of UO_2 fuel, 16: 24615
BROWNING, William E., Jr., Removal of radioiodine from gases, 16: 24649
BROWNSON, Robert H., Exposure of central nervous system to x irradiation, 16: 23474
BRUGGER, H. B., Effect of burnup on Darex and Sulfex head-end processes, 16: 24644
BRUNHOUSE, J. S., Oxidation of UO_2 and BeO–UO_2 fuel pellets, 16: 24621
BRUNINX, E., Spallation of Cu with 24-Bev protons, 16: 24859
BRUNOT, W. K., Fuel element surface temperature, 16: 24505
BRUSTAD, Tor, Changes in brain caused by α particles, 16: 23492
BRYANT, D. A., Scintillation counter telescope, 16: 23925
BRYANT, G. H., Propagation in plasma-filled waveguide, 16: 24893
BRYNSVOLD, G., Conceptual design of Mixed Spectrum Superheater, 16: 24473
BUBERNAK, J., Determination of burnup in Pu reactor fuels, 16: 23628 (TID-7629(p.177-83))
BUCKINGHAM, A. D., Nuclear quadrupole coupling in ionic molecules, 16: 24654
BUDAGOV, Yu. A., Interaction of π^- mesons with He, 16: 24682 (JINR-P-868)
BUDDE, R., Hyperon and kaon production, 16: 24737
BUDWORTH, D. W., Calibration curves for density-gradient columns, 16: 23938
BUECHNER, W. W., Surface analysis by nuclear particle scattering, 16: 24568
BULMER, J. J., Two-dimensional thermal spectrum calculations, 16: 24387
BUMPUS, C. F., Jr., Production of void and pressure in solution reactor, 16: 24533

BUNCH, W. L., Shielding studies for power reactor, 16: 24593
BURCH, W. D., Production of transuranium elements, 16: 24340
BURDG, C. E., Vibratory compaction of UO_2 fuel elements, 16: 24621
BURDG, Charles E., Thermal testing of UO_2 fuel elements, 16: 24620
BURE, J., Action of γ rays on flour, 16: 24041
BUREAU, A. J., Photoproton reaction in Be-9, 16: 24857
BURGAN, B. L., Leak testing headlamp units using radioactive gas, 16: 24585
BURKHARDT, W., Measurement of low-surface-area U compounds, 16: 23640 (TID-7629(p.331-44))
BURLANT, W., Gamma irradiation of p-substituted polystyrenes, 16: 23742
BURLEY, H. A., Ytterbium-169 for industrial radiography, 16: 24584
BURNS, R. H., Ground disposal of radioactive wastes, 16: 25075 (TID-7628(p.583-9))
BURR, Richard H., Jr., Urinary U study on plant operators, 16: 23380 (TID-7616(p.99-100))
BURRILL, E. A., Activation analysis for materials testing, 16: 23964 (ANL-6515(p.9-27))
BURROUGHS, E., Control rod latch reliability, EOCR, 16: 24982 (IDO-16775)
BURTON, H. S., Radio-chromatogram scanner, 16: 23940
BURTON, W. G., Radiation process for inhibition of sprouting in potatoes, 16: 23411 (AERE-R-3977)
BUSING, W. R., Fortran program for single crystal absorption corrections, 16: 24095 (ORNL-TM-229)
BUTLER, C. P., Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
BUTLER, W. R., Effects of space radiation of startup of orbiting reactors, 16: 24547
BUTTON, Janice, Pion-pion interaction, 16: 24750
BYERS, F. M., Jr., Data on tuff of tunnel system, Nevada Test Site, 16: 23987 (TEI-811)

C

CABIBBO, N., Quantum electrodynamics with Dirac monopoles, 16: 24927
CABLE, J. W., Magnetic structures of Tm, 16: 24204
CAILLAT, R., Mechanism of reaction hot pressing, 16: 24136
CALLAHAN, Emerson D., Radiation hazard from water and milk after nuclear attack, 16: 24014 (NP-11715)
CALLAN, Edwin J., Concrete for radiation shielding, 16: 24221
CALLESEN, O., Radioactive isotopes in coastal engineering, 16: 23995
CALVO, W. G., Human tolerance to thermal neutrons, 16: 23495
CAMERA, V., Colorimetric determination of U, 16: 23600 (CNI-57)
CAMERON, A. E., Mass spectrometer analyzer tube assembly, 16: 23857 (Y-1393)
CAMPBELL, Berry, Action potential change by β irradiation, 16: 23504
CAMPBELL, E. M., Scattering of γ rays off concrete, 16: 24911
CAMPBELL, W. M., Canada's organic cooled reactor program, 16: 24452
CAMPBELL-ALLEN, D., Concrete for shielding atomic energy plants, 16: 24225
CAMPISE, A. V., Analysis of first AETR, 16: 24408
CAMPLANI, Angelo, Calculation of control rod differential worth, 16: 24404
CANDELORE, N. R., Doppler broadened resonance absorption, 16: 24439
CANNINGS, F. R., Dehydrocyclization of 2,2-dimethyl-4-(methyl-C^{14})-pentane, 16: 23565
CANNON, G. A., APWRC-GAMICO—modification of GAM-I for PWR, 16: 24945 (MND-C-2500-5)
CANOBBIO, E., Doppler effect in plasma, 16: 24897
CAPEK, Raymond George, Solid solutions of Na niobate, 16: 23687
CARDEN, P. O., Large homopolar generator, 16: 24877
CARLSMITH, Roger S., Sensitivity of reactivity lifetime to fission-product cross sections, 16: 24384
CARLSON, W. J., Analysis of power ramp measurements, 16: 24529
CARNASALE, A., Prog. rpt. on PM-1 nuclear power plant, 16: 24983 (IND-M-1866)
CARPENTER, F. D., Prog. rpt. on carbides for thermionic space reactors, 16: 24154 (GA-3245)
CARPENTER, S. G., Neutron importance in mixed-spectra critical assemblies, 16: 24418
CARPENTER, S. G., Reactivity measurements in AETR, 16: 24407
CARROLL, R. M., Release of fission gas from UO_2, 16: 24219
CARROLL, T. W., In-pile irradiation of Santowax OMP, 16: 24455
CARROTHERS, M. R., Absorber burnup experiment, 16: 24486
CARSON, A. S., Tritium-labeled organic compounds, 16: 23589
CARSTEN, A., X irradiation and delayed myelomalacic, 16: 23483
CARTER, W. L., Processing Th reactor fuels, 16: 23789 (ORNL-TM-241)
CARTLEDGE, G. H., Corrosion processes and their inhibition, 16: 23593
CARVER, D. R., Effect of seismic vibrations on EGCR, 16: 24986 (ORNL-3224)
CASALETTO, G. J., Self-radiation oxidation of H-3, 16: 23717 (USNRDL-TR-565)
CASEY, J. P., Heat transfer of irradiated Santowax OMP, 16: 24456
CASEY, J. P., In-pile irradiation of Santowax OMP, 16: 24455
CATHEY, L., Solid-state α counters in process streams, 16: 23902
CECCALDI, M., Heavy water analyzer, 16: 23623 (TID-7629(p.91-109))
CECCHI, Franco Micucci, Financial protection by atomic hazard insurance, 16: 24025
CEGELSKI, Walter M., Shielding program for SNAP reactor systems, 16: 24594
CERMAK, Harry, Radioisotope lab. for building materials research, 16: 23981
CERNIGOI, C., Performances of fast-response photomultipliers, 16: 23865
CERRE, P., Treatment of solid radioactive waste, 16: 25034 (CEA-2147)
CHAGNON, P. R., Gamma spectra of W isotopes, 16: 24840
CHAHOUD, J. H., Pion-pion interaction, 16: 24744
CHALYI, A. V., Influence of distortions of lattices of x rays, 16: 24212
CHAMPLIN, Jerry B. F., Injecting solutions into permeable rocks, 16: 25056 (TID-7628(p.324-46))
CHAND, Prakash, Capture rates of μ^- by nuclei, 16: 24826
CHANG, M. C., Effects of x radiation on ova, 16: 23416 (TID-16121)
CHANG, N. P., Corrections to $K \to e\nu$ and $K \to \mu\nu$ decays, 16: 24700 (TID-16108)
CHANG, Shih-tse, Radiochemical determination of K, 16: 23647
CHAO, Tsun Tien, Determination of sulfate adsorption by soils, 16: 23539
CHAPEVILLE, F., Preparing sulfurated substances, 16: 23561
CHARLESWORTH, D. H., Fouling of heat transfer surfaces by organic coolants, 16: 24459
CHASE, L. F., Jr., Gamma rays from B-10, 16: 24830
CHASE, R. L., Multichannel pulse-height analysis, 16: 23911 (BNL-5993)
CHATO, John C., Flow and stability in multiple-channel natural convection systems, 16: 24506
CHATTERJEA, J. B., Study on Fe turnovers, 16: 23391
CHAUMONT, J. M., Two-dimensional perturbation code and application to EBR, 16: 24441
CHELEMER, H., Boundary of local boiling region in PWR cores, 16: 24509
CHEMYANOV, G. G., Influence of fresh bone marrow in radiation sickness, 16: 23525
CHEN, Catherine S. Hsia, Polymerization induced by ionizing radiation. I., 16: 23740
CHEN, Catherine S. Hsia, Polymerization induced by ionizing radiation. II., 16: 23741
CHENEBAULT, P., Preparation of UO_2 in powder room, 16: 24098 (EURAEC-57(App.1))
CHENEBAULT, P., Preparation of UO_2 powder for Fiat (Turin), 16: 24101 (EURAEC-57(App.4))
CHERNICK, J., Nonlinear reactor dynamics problems, 16: 24523
CHERNIKOV, N. A., Surface of special points of Feynman's diagram, 16: 24683 (JINR-P-889)
CHERNILIN, Yu. F., Production of pure fast-neutron fluxes, 16: 24705
CHERNOCK, W. P., Development and testing of enriched ceramic fuels, 16: 24625
CHERNOCK, W. P., Vibratory compaction of UO_2 fuel elements, 16: 24621
CHERNOV, G. A., Enterochromaffin cells of duodenum in acute radiation sickness, 16: 23519
CHERON, Theodore, Bibliography on BeO, 16: 24140 (AD-269729)
CHETHAM-STRODE, A., Production of transuranium elements, 16: 24340
CHIANG, Tao-I, Reduced states of Group IV elements, 16: 23682
CHIFFELLE, T. L., Blast effects in shelters on animals and dummies, 16: 24017 (WT-798)
CHIH-MIN, Li, Isotope effects in β decay of Pb isotopes, 16: 23722 (AEC-tr-5150)
CHILDS, Charles B., Recording heavy primary cosmic radiation, 16: 23931

CHILTON, A. B., Differential dose albedo for γ rays on concrete, 16: 24599
CHITTENDEN, W. A., Containment vessel studies for HTGR, 16: 24489
CHITTENDEN, W. A., Heavy water reactor plant leakage, 16: 24499
CHIU, Hong-yee, Neutrino astronomy, 16: 24659
CHIZHOV, V. P., Photonuclear reactions with deuteron emission, 16: 24835
CH'LEN, Pao-kung, High polymer radiation chemistry, 16: 23748
CHOPPIN, G. R., Ion exchange of lanthanide and actinide systems, 16: 23571
CHRISTENSEN, J. A., Irradiation of UO_2 single crystal, 16: 24608
CHRISTENSEN, N. Hesselbjerg, Preparation of I^{131}-labeled pipsan, 16: 23560
CHRISTENSON, C. W., Movement of Pu through LA tuff, 16: 25054 (TID-7628(p.248-81))
CHUBURKOV, Yu. T., Nuclear reaction $Th^{232}(Ne^{22},4n)Fm^{250}$, 16: 24781 (JINR-P-896)
CHYSKY, Jaromir, Problems of radiation hygiene, 16: 24030
CIULLI, I., Extrapolation of experimental scattering amplitude, 16: 24312
CIULLI, S., Extrapolation of experimental scattering amplitude, 16: 24312
CLAESSON, Arne, Distribution of neutrons from pulsed plane source, 16: 24758 (AE-71)
CLAIBORNE, H. C., Effect of neutron-energy spectrum on radiation damage of steel, 16: 24638
CLARK, C. L., Evaluation of superheater tube alloys, 16: 24126
CLARK, H. K., Refinements in two-group calculations, 16: 24401
CLARK, L., Jr., Operating costs of MIT Reactor, 16: 24491
CLARKE, Eric T., Gamma scattering by nearby surfaces, 16: 24604
CLARKE, Eric T., Radiation hazard from water and milk after nuclear attack, 16: 24014 (NP-11715)
CLARKE, I. D., Radiation process for inhibition of sprouting in potatoes, 16: 23411 (AERE-R-3977)
CLASS, C. M., Beta decay of Sc-41, 16: 24836
CLAY, Margaret L., Elevation of LD_{50} level in *Planaria*, 16: 23414 (TID-15984)
CLAYTON, E. D., Critical mass experiments with $Pu(NO_3)_4$, 16: 24416
CLAYTON, E. D., Experience in Hanford Pu critical mass facility, 16: 24417
CLEEK, G. W., Thermal expansion of Al_2O_3 and ThO_2, 16: 24190
CLEMENTE, C. D., Effects of radiation on neonatal brain, 16: 23477
CLEMENTE, Carmine D., Effects of head irradiation in newborn rats, 16: 23475
CLEMENTE, Carmine D., Radiation effects on blood-brain barrier, 16: 23493
CLIKEMAN, F. M., Photoproton reaction in Be-9, 16: 24857
CLINE, T. L., Spectrometer to search for positrons in space, 16: 23924
CLOSE, Paul T., Zirconium oxide and boron–silicon refractories, 16: 23599 (ARL-180)
CLUSIUS, K., Nitrogen isotope separation during HNO_3 production, 16: 24079
CLUSIUS, K., Vapor pressure of SO_3 and SO_3^+, 16: 23693
COBB, John, Neutronic reactor, 16: 24958
COBLE, O. V., Analysis of dense BeO, 16: 23624 (TID-7629(p.135-41))
COCHRAN, E. L., ESR of alkali atoms in inert-gas matrices, 16: 23702
COCHRAN, L. W., Diffusion of slow electrons in gases, 16: 24325
COE, R. J., Yankee plant and reactor performance, 16: 24467
COEKELBERGS, R., Elementary carbon exchange, 16: 23576
COFIELD, R. E., Radioactivity distributions in processing Th, 16: 23373 (TID-7616(p.3-38))
COHAN, Morton D., Radiations from spent fuel elements, 16: 24352
COHEN, E. Richard, Resonance absorption of neutrons. II., 16: 24390
COHEN, Edward, Underground shelters tested at Plumbbob, 16: 24019 (WT-1453)
COHEN, Edward, Underground personnel shelters, 16: 24020 (WT-1454)
COHEN, Morris, Diffusion in Co–Ni alloys, 16: 24169 (NYO-9430)
COHEN, S., Control rod latch reliability, EOCR, 16: 24982 (IDO-16775)
COHEN, Stanley, Deformation energy of a charged drop. IV., 16: 24803
COLBETH, E. A., APWRC-SYBURN—program for burnup calculations, 16: 24944 (MND-C-2500-4)
COLE, Arthur G., Experiments involving gaps in critical assemblies, 16: 24420
COLE, Arthur G., Experiments with Ni as reflector material, 16: 24421
COLLINS, C. J., Radiochemistry of deamination reactions, 16: 23564
COLLINS, Kenneth Elmer, Neutron capture in organic bromides, 16: 23731
COLLINS, T. Lee, Jr., Solid-sample mass spectrometry, 16: 23625 (TID-7629(p.142-50))
COLOMB, A. L., Measurement of spectral density of reactor power fluctuations, 16: 24549
COLTMAN, M., Rotating mirror smear camera for arc discharge studies, 16: 23936
COMPAAN, K., Interacting polarized particles, 16: 24745
COMPRELLI, F. A., Materials for nuclear superheat applications, 16: 24155 (GEAP-3875)
CONNERS, T. F., Radioisotopic study of gyro bearing lubrication, 16: 24032
CONNOLLY, T. F., Bibliography on reactor fuel reprocessing and waste disposal, 16: 23785 (ORNL-2971(Vol. 3))
CONNOLLY, T. F., Bibliography on reactor fuel reprocessing and waste disposal, 16: 23784 (ORNL-2971(Vol. 1))
CONNOR, J. C., Uranium-235 fission-product poison experiments, 16: 24381
CONNORS, C. R., Refractory metal alkoxides, 16: 24147 (ASD-TDR-62-90)
CONSTANT, Rene, Production and use of radioelements, 16: 24049
CONSTANTINE, G., Shielding calculations for Daphne. I., 16: 25026
CONSTANTOULAKIS, Matthew, Radiative and antiglobulin test, 16: 23435
CONWAY, D. E., Uranium-235 fission-product poison experiments, 16: 24382
COOKE, I., Energy resolution of NaI scintillators, 16: 23882
COOMBE, J. R., Hazards report for PM-2A Core II, 16: 24966 (APAE-121)
COOPER, M. D., Surface composition based on nuclear bombardment data, 16: 24569
COOPER, R., Tritium-labeled organic compounds, 16: 23589
COOPER, W. A., Hyperon and kaon production, 16: 24737
CORBETT, John D., Titrimetric method for Ga, 16: 23645
CORDOVI, M. A., Evaluation of superheater tube alloys, 16: 24126
CORNET, C., Separation of Zr and Hf, 16: 23792 (AEC-tr-5099)
CORNGOLD, Noel, Phase integral study of heavy gas model, 16: 24378
CORSBIE, Robert L., Communal shelter evaluation, 16: 23359 (WT-360)
CORTELLESSA, G., Photoproduction in H of ω^0 meson, 16: 24680 (ISS-61/41)
CORYELL, Charles D., Charge distribution in nuclear fission, 16: 24351
CORYELL, Charles D., Surface analysis by nuclear particle scattering, 16: 24567
COSTA, S., Photodisintegration of S, 16: 24842
COSTEA, Nicolae, Radiative and antiglobulin test, 16: 23435
COSTELLO, D. C., Land burial of radioactive wastes, 16: 25062 (TID-7628(p.396-427))
COTTERELL, K., Use of CCl_4 as radiopaque penetrant, 16: 23978
COWSER, K. E., Land burial of solid waste, 16: 25064 (TID-7628(p.437-59))
COWSER, K. E., Movement of Ru in waste-pit system, 16: 25071 (TID-7628(p.513-31))
COX, F. H., Prog. rpt. on PM-1 nuclear power plant, 16: 24983 (MND-B-1866)
CRAMER, John G., Jr., Beta decay of Sc-41, 16: 24836
CRANDALL, J. L., Measurements of U–D_2O lattices, 16: 24355
CRANE, J., Melting and casting of UC, 16: 24134 (TID-15337)
CRANE, J., Prog. rpt. on nuclear fuel research, 16: 24168 (NYO-2690)
CRIMMINS, D. H., Control of boiling water reactor, 16: 24531
CRONIN, J., Ionization effects in spark chambers, 16: 23908
CRONIN, James W., Spark chambers, 16: 23907
CRONKITE, E. P., Changes in bone marrow following body irradiation, 16: 23429 (BNL-5032)
CRONKITE, E. P., Stability of vitamin B_{12}–Co^{60} content of liver, 16: 23397 (BNL-4888)
CRONKITE, Eugene P., Lymphopenia produced by irradiation, 16: 23404 (BNL-6011)
CROOK, J. M., Design technology for GCR. I-III., 16: 24967 (APEX-400 (Pt.A))
CROSSLEY, D. A., Jr., New species of soil-inhabiting mite, 16: 23303
CROWTHER, Russell L., Shielded Th fuel element, 16: 24959
CULP, A. W., In-pile loop for EGCR, 16: 24987 (ORNL-TM-108)
CURRIN, H. B., Significant parameters in DNB, 16: 24507
CURTIS, Howard J., Changes in irradiated nerve cells, 16: 23494
CURTIS, Howard J., Effect of deuteron microbeam on mouse lens, 16: 23428 (BNL-6081)

D

DAHL, R. E., Reactor graphite combustion, 16: 24482
DAHLSTROM, T. S., Angular distribution of dose rate due to γ rays, 16: 24600
DAHLSTROM, T. S., Dose from γ rays scattered through Fe and Al, 16: 24906 (USNRDL-TR-558)
DAIMKO, J. L., Alkaline hydrolysis of S-adenosylmethionine, 16: 23729
DAKE, P. G., Nitrogen adsorption-desorption measurements, 16: 23641 (TID-7629(p.345-56))
DALTON, G. Ronald, Effects of anisotropy on detector flux depression, 16: 24365
DAMESHEK, William, Radiative and antiglobulin test, 16: 23435
DAMFORTH, J. P., Analysis of Si in cast Fe, 16: 24573
DANIEL, J. L., Irradiation of UO_3 single crystal, 16: 24608
DANOS, M., Electron resonance magnetometer, 16: 23947
DARON, Harlow Hoover, Inositritane and H-3 incorporation, 16: 23390
DARRAS, R., Oxidation of Nicral D and Hastelloy X, 16: 24124 (AEC-tr-5235)
DAS GUPTA, A. K., Safety for industrial radiography using radioisotopes, 16: 24029
DAUDEL, Pascaline, Radioactive tracers in chemistry and industry, 16: 24072
DAUPHIN, J., Study of pentane and cyclopentane radiolysis, 16: 23587
DAVEY, Peter, SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)
DAVIDSON, A. J. S., Data plotting system for use with punched paper tape, 16: 23843 (CREL-1009)
DAVIDSON, S. L., Thermal analysis of Type 3 elements, 16: 24965 (APAE-105)
DAVIES, K. T. R., Symmetry properties of S matrix, 16: 24916 (NP-11738)
DAVIS, D. G., Symbols for instrument flowsheets and drawings, 16: 23353 (CF-57-2-1(Rev.1))
DAVIS, Dean Trafford, Magnetically focused electron beam, 16: 24297
DAVIS, H. S., Shielding studies for power reactor, 16: 24593
DAVIS, Harold S., Concrete for shielding atomic energy plants, 16: 24224
DAVIS, Harold S., Concrete made with Fe aggregate, 16: 24226
DAVIS, Harold S., Concrete made with hydrous-Fe aggregates, 16: 24227
DAVIS, Roger T., Performance of monkeys after irradiation to head, 16: 23512
DAVIS, W., Jr., Head-end treatment of low level wastes, 16: 25036 (ORNL-TM-360)
DAY, R. P., Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
DAYKIN, P. N., Spectra of partially deuterated and tritiated stibines, 16: 23705
DEAL, L. J., Radiation in shelters and instrumentation, 16: 24016 (WT-789)
DEARNALEY, G., Semiconductor fast neutron detectors, 16: 23899
DE BROUCKERE, L., Radioactive indicators in chemistry, 16: 23563
DEBUCHY, D., Synthesis of iodized organic compounds, 16: 23559
DE CELLES, Paul C., Kinematic structure of vertex functions, 16: 24860
DECHAND, C. O., Analysis of critical experiments, 16: 24409
DECOT, J., Elementary carbon exchange, 16: 23576
DE FOREST, R. D., Sensitivity of pressure transducers, 16: 24554
DE GIOVANNI, Rosalie, Effects of D_2O on microorganisms, 16: 23388
DE GIOVANNI, Rosalie, Effects of D_2O on bacteria, 16: 23404
DEJONGHE, P., Movement of radioactive substances in ground. II., 16: 25046 (TID-7628(p.155-65))
DEJONGHE, P., Movement of radioactive substances in ground. III., 16: 25050 (TID-7628(p.198-210))
DEKA, G. C., Ejection of Li-9 hammer track, 16: 24827
DE KLERK, J., Ultrasonic cw spectrometer, 16: 23950
DELARUE, Guy, Properties in molten LiCl–KCl, 16: 23675 (HW-tr-40)
DELCROIX, J.-L., Adiabatic waves in plasma, 16: 24880 (APCRL-896 (Pt.II))
DE LEEUW, J. H., High-speed spark camera, 16: 23852 (UTIA-TN-26)
DELVAILLE, John Paul, Isotropy of high-energy cosmic rays, 16: 24665
DELYSER, H., Detectors for space spectrometry, 16: 23928
DE MASTRY, J. A., Niobium–U alloys for elevated temperature, 16: 24633
DENCHEV, R., Integral equation of type of low-scattering equation, 16: 24913 (JINR-P-890)
DENCHEV, R., Operators in low-scattering equation, 16: 24914 (JINR-P-901)
DE NERCY, Andre Bussiere, Resonant scattering of photons, 16: 24703
DENISON, R. R., Prog. rpt. on Fe–Cr–Al alloys, 16: 24156 (GV-298)
DENISSE, J.-F., Adiabatic waves in plasma, 16: 24880 (APCRL-896 (Pt.II))
DEPAUX, Brigitte, Multiple scattering of charged particles, 16: 24702
DE RAAD, B., Radiation sources and costs, 16: 24046
DE ROSIER, T. A., Design technology for GCR. VIII., 16: 24968 (APEX-800(Pt.F))
DERRICK, G. H., Triton matrix elements, 16: 24833
DE SAUSSURE, G., Manganese bath measurements of η of Pu-239, 16: 24431
DESPAIN, Lewis Gail, Bound muon decay in Fe and Zn, 16: 24819
DETIFFE, G., UO_2 sinterings preliminary to irradiations in EL3, 16: 24105 (EURAEC-57(App.8))
DEUTSCH, R. W., Neutron flux distributions in Fe–H_2O shields, 16: 24597
DE VAN, J. H., Corrosion by molten fluorides, 16: 23594
DEVILLERS, D., Reaction $Si^{28}(\alpha,\alpha)Mg^{24}$, 16: 24846
DE VOLPI, A., Rejection of γ background pulses in Hornyak buttons, 16: 23916 (UAC-6092)
DE ZEEUW, D., Hood, for work with radioisotopes, 16: 23811
DICKE, R. H., Long-range scalar interaction, 16: 24753 (PUC-1962.58)
DICKERMAN, P. J., Arc jet for producing temperature simulation in wind tunnel, 16: 24885 (ASD-TR-61-283)
DICKERSON, R. F., Evaluation of Th and Th–U compounds, 16: 24630
DICKERSON, R. F., Irradiation-induced property changes in Ta, 16: 24639
DICKERSON, R. F., Niobium–U alloys for elevated temperature, 16: 24633
DICKS, J. B., Gas dynamics of Ar plasma, 16: 24879 (AEDC-TDR-62-88)
DIETZ, R. J., Jr., Solvent extraction studies of halides, 16: 23582
DI MENZA, Raffaele, Progress on Ralian organic reactor program, 16: 24454
DI NOVI, Roberto Ann, Symposium on physics and nondestructive testing, 16: 23963 (ANL-6515)
DIRENDE, J., Flow tests of BR-2 fuel elements, 16: 24985 (NDA-2561-1)
DJURIC, Dusan, Antimony-124 chloride in rat following inhalation, 16: 23386 (UR-608)
DMITRIEV, V. I., Diffraction of EM waves on conducting plate, 16: 24713
DNESTROVSKII, Yu. N., Electromagnetic waves theory in plasma, 16: 24899
DOBBS, Norval, Underground shelters tested at Plumbbob, 16: 24019 (WT-1453)
DOBICI, Franco, Chromatography of inorganic ions on Zr phosphate paper, 16: 23650
DOBO, J., Manufacture of dyeable polytetrafluoroethylene with radiochemical copolymerization, 16: 24207
DOGADKIN, B. A., Transformation of rubbers under γ radiation, 16: 23543
DOLLOFF, R. T., Prog. rpt. on metal carbides, 16: 24798 (WADD-TR-60-143(Pt.III))
DOMINGET, R., Oxidation of Nicral D and Hastelloy X, 16: 24124 (AEC-tr-5235)
DONETS, E. D., Nuclear reaction $Th^{232}(Ne^{22},4n)Fm^{250}$, 16: 24781 (JINR-P-896)
DONOHUE, H. F., Fuel rod bowing in SRE, 16: 24536
DORFMAN, L. M., Labeling by electric discharge, 16: 23548
DOROSZEWSKI, J., Radiation effects on thyroid function, 16: 23431
DOUGLASS, D. L., Materials for nuclear superheat applications, 16: 24155 (GEAP-3875)
DOYLE, Thomas A., Critical studies for Enrico Fermi Reactor Core B, 16: 24410
DRAGUT, A., Initiation of peroxidation reaction by radiation, 16: 23751
DRENNEN, D. C., Properties of Mar-Aging steels, 16: 24153 (DMIC-Memo-156)
DREUTLER, U., Measurement and analysis of nuclear radiation. I-II., 16: 23874
DROWART, J., Mass spectrometric study of B–C, 16: 24177 (WADD-TR-60-782(Pt.VIII))
DRUCKER, Eugene E., Steam-pressurizer surge tank, 16: 24503
DRUMMOND, C. H., Zirconium oxide and boron–silicon refractories, 16: 23599 (ARL-180)
DUDEK, J. A., Nuclear data for GAM-I data tape, 16: 24068 (GA-2451 (Vol.II))

DUFFY, T. L., Air analyses of halogenated hydrocarbons, 16: 23384 (TID-7616(p.211-21))
DUNAITSEV, A. F., Conserved vector current hypothesis, 16: 24691 (JINR-P-968)
DUNAITSEV, A. F., Detection of charge exchange in π^- mesons, 16: 24689 (JINR-P-948)
DUNAVENT, Billy Glenn, Characteristics of 4π detector, 16: 23871
DUNCAN, Donald, Cytoplasmic DNA in irradiated neutral tube, 16: 23476
DUNCOMBE, W. G., Observation of an isotope effect, 16: 23579
DUNEER, Arthur G., Jr., Gamma dose from solar flare protons incident on Al, 16: 24591
DUPZYK, Isabelle, Urinalysis for Cm, 16: 23374 (TID-7616(p.39-50))
DURAND, Loyal, III, Kinematic structure of vertex functions, 16: 24860
DURRILL, D. C., Observations of SL-1 incident effects, 16: 24513
DYCHNO, H. M., Isotopic analysis of waters, 16: 23661
DYE, D. L., Biological shielding for radiation belt particles, 16: 24910
DYER, A. S., Turbulent diffusion in ground layer of atmosphere, 16: 23991 (AWRE-Trans-34)
DYRSSEN, David, Determination of U(VI), 16: 23644
DZANTIEV, B. G., Effect of radiation on Teflon and other polymers, 16: 23720 (AEC-tr-5144)
DZANTIEV, B. G., Obtaining sulfur-labeled compounds, 16: 23550
DZANTIEV, B. G., Synthesis of T-labeled cyclic hydrocarbons, 16: 23549
DZHAGATSPANYAN, R. V., Chlorination of organo-silicon monomers and polymers under γ rays. I., 16: 23759

E

EBER, J., Interaction of Hg with erythrocytes, 16: 23393
EBERLE, F., Scaling of superheater tube alloys, 16: 24125
EBERSOLE, Earl R., Determination of Ra-226 and Th-230, 16: 23383 (TID-7616(p.147-75))
EBERSON, Lennart, Carbonation of Grignard reagents, 16: 23531
EFIMOVA, B. A., Scattering by ionic impurities in Bi_2Te_3, 16: 24213
EGELSTAFF, P. A., Neutron-scattering studies of liquid diffusion, 16: 24271 (AERE-R-4043)
EGOROV, E. V., Effect of radiation on Teflon and other polymers, 16: 23720 (AEC-tr-5144)
EGOROV, L. B., Anomalies in μ^- meson decay in mesotons, 16: 24278 (JINR-P-971)
EICHLER, J., Angular distribution of protons, 16: 24800 (UCRL-Trans-828(L))
EIDSON, W. W., Thin diffused-junction counters, 16: 23898
EITZ, A. W., Thermal cross sections and homogeneous burnup of reactor, 16: 25013 (BLG-69)
EKBERG, Solveig, Determination of U(VI), 16: 23644
ELDRIDGE, H. B., Proton recoil energy loss distribution, 16: 24791 (ORNL-3089)
ELDRIDGE, J. S., Gamma spectrometer for nondestructive inspection, 16: 24555
ELKINS, P. E., Properties of PbTe, 16: 24161 (NAA-SR-Memo-7172)
ELKINS, S. R., Prog. rpt. on high temperature ceramics, 16: 24132 (NP-11713)
ELLARD, J. A., Physical and thermodynamic properties of biphenyl, 16: 24461
ELLEMAN, T. S., Measurement of short-lived fission gases, 16: 24563
ELLEMAN, T. S., Xenon release from recoil-damaged Al_2O_3, 16: 24619
ELLEMAN, Thomas S., Radiochemical separation of short-lived fission products, 16: 24564
ELLIOTT, D. D., Proton spectrometer, 16: 23832 (AD-269867)
ELLIOTT, F. C., Radiation-induced recombination in octoploids, 16: 23454
EL-NESR, M. S., Decay of Hf-175, 16: 24806
EL-NESR, M. S., Decay of Hf-181, 16: 24807
EL-NESR, M. S., Decay of Yb-175, 16: 24808
ELSEA, A. R., Decarburization effects on steels, 16: 24152 (DMIC-Memo-154)
EMBERSON, D. L., Transmission-type intensifier, 16: 23891
EMERY, J. F., Determination of minor elements in Be, 16: 23634 (TID-7629(p.245-57))
EMERY, J. F., Trace element determination in Nb and Zr, 16: 23633 (TID-7629(p.239-44))
EMMER, T. L., Scintillation and semiconductor spectroscopy, 16: 23846 (ORNL-TM-137)
EMPSON, F. M., Storage of low-level packaged solids, 16: 25067 (TID-7628(p.469-76))
EMPSON, F. M., Storage of high-level packaged solid wastes, 16: 25068 (TID-7628(p.477-90))
ENG, G. H., Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)
ENGEL, J. R., Safety calculations for MSRE, 16: 24988 (ORNL-TM-251)
ENGELKE, Charles Edward, Measurements of (n,p) total cross section, 16: 24706
ENGELKEMEIR, D. W., Positron emission in decay of K-40, 16: 24856
ENGELMANN, Peter, Modern development of breeder reactors, 16: 25011
ENGELS, E., Ionization effects in spark chambers, 16: 23908
ENUESTUEN, B. V., Solubility of $SrSO_4$, 16: 23592
ERGEN, W. K., Effect of fuel-rod bowing in Spert-1, 16: 24535
ERGEN, W. K., Measurement of dynamic Doppler coefficient, 16: 24517
ERICKSON, Ernest Eugene, Electron interaction in klystron gaps, 16: 24291
ERMOLOV, P. F., Interaction of π^- mesons with He, 16: 24682 (JINR-P-868)
ERNST, Hanns, Radiation conditioned changes in cell proteins. II., 16: 23468
ERRAMUSPE, H. J., Scattering and stripping of deuterons on N, 16: 24831
ESHAYA, Allen M., Absorption and diffusion of Xe, 16: 23700
EVANS, R. B., Corrosion by molten fluorides, 16: 23594
EVANS, R. M., Electron-beam welding of W, 16: 24131 (DMIC-Memo-152)
EVETT, A. A., Coordinate conditions from variational principles, 16: 24315
EWEN, R. L., Complex natural modes for spatial Xe, 16: 24544
EWING, R. A., Effect of burnup on Darex and Sulfex head-end processes, 16: 24644
EWING, R. I., Response of Si surface barrier detectors, 16: 23904 (SCDC-2522)
EYMERY, R., Intensive radiation sources, 16: 24050

F

FADEEVA, V. I., Gravimetric determination of Zr, 16: 23660
FAGLEY, R. K., By-pass valve bearing development, 16: 23801 (DC-60-1-37)
FAIRSTEIN, E., Fission chamber and preamplifier assembly for high-flux, 16: 24552
FALER, K. T., Uranium-235 mass yields below 0.5 ev, 16: 24349
FANG, S. C., Determination of sulfate adsorption by soils, 16: 23539
FANG, Show-hsien, Cyclotron with spatial magnetic variation, 16: 24870
FARKAS, Jozsef, Insect control by radiation, 16: 24053
FARKAS, M. S., Evaluation of Th and Th–U compounds, 16: 24630
FARLEY, C. W., Fission-fragment irradiation of methane, 16: 24589
FARNSWORTH, R., Determination of U in waste products, 16: 23637 (TID-7629(p.285-94))
FARR, L. E., Human tolerance to thermal neutrons, 16: 23495
FARR, Lee E., Educational concepts in nuclear medicine, 16: 23366 (BNL-4931)
FASOLI, U., Capture ratio in Cr-51 decay, 16: 24844
FAUPELL, L. C., Examination of SL-1 core and pressure vessel, 16: 24521
FEDERIGHI, F. D., Calculating fast group diffusion theory parameters, 16: 24400
FEDERIGHI, F. D., Spatially dependent spectra, 16: 24370
FEDOSEEV, I. V., Reduction of U oxides and UO_2F_2, 16: 24187
FEDOTOV, V. N., Spin-lattice relaxation time in supercooled solutions of Ti^{3+}, 16: 23703
FEELY, Herbert W., Prog. rpt. on Project Star Dust, 16: 23407 (DASA-1302)
FEIN, E., Analysis of critical experiments, 16: 24409
FELBERBAUM, J., Adjusted values of cross sections of U-233, U-235, and Pu-239, 16: 24383
FELDMAN, David, Prog. rpt. on high-energy physics, 16: 23850 (TID-16074)
FELDMAN, Isaac, Reaction of uranyl ion with amino acids, 16: 23307 (UR-611)
FELDMAN, Myra S., Radio-activation analysis in industry, 16: 23643 (AEC-tr-5116)
FENG, P. Y., Radiation-induced alkylation of aromatics, 16: 24580
FERGUSON, A. T. G., Semiconductor fast neutron detectors, 16: 23910

FERGUSON, D. E., Prog. rpt. on transuranium elements, 16: 23528 (ORNL-3290)
FERGUSON, H. A., Investigations for Europoort project, 16: 24004
FERGUSON, R. L., Evaluation of U-233 fission yield data, 16: 24792 (ORNL-3305)
FERRARI, E., Quantum electrodynamics with Dirac monopoles, 16: 24927
FERRONI, S., Photodisintegration of S, 16: 24842
FEUCHTWANG, T. E., Electron–nuclear double resonance spectrum in alkali halides, 16: 24317
FEUCHTWANG, T. E., Hyperfine interaction constants in alkali halides, 16: 24316
FIDONE, I., Bremsstrahlung and friction in plasma, 16: 24898
FIESENHEISER, E. I., Heavy steel–aggregate concrete, 16: 24228
FILATOV, E. S., Chemical effects of nuclear transformations, 16: 24861
FILATOV, E. S., Isotope effect of Br recoil atoms in (n,γ) process, 16: 23723 (AEC-tr-5151)
FILIPCHUK, E. V., Protection systems for reactors, 16: 24954
FILLMORE, F. L., ARES—resonance integral code, 16: 24391
FILTHUTH, H., Hyperon and kaon production, 16: 24737
FINK, F. W., Corrosion analysis of VPP components, 16: 24118 (BMI-X-201)
FINK, Richard D., Charge distribution in nuclear fission, 16: 24351
FINKEL, Miriam P., Osteosarcomas studied by serial roentgenography, 16: 23464
FINSTON, H. L., Nuclear and radiochemical techniques in analysis, 16: 24562
FIORINI, E., Beta decay of negative muon, 16: 24725
FIRSOV, Yu. A., Superconductivity in semiconductors, 16: 24332
FISCHER, G. J., CYCLE and COST—codes for fast reactor fuel cycle analysis, 16: 24437
FISCHER, G. J., Fuel cycle studies, 16: 24484
FISCHER, J., Extrapolation of experimental scattering amplitude, 16: 24312
FISCHER, Joachim, Delay between particle passage and chamber spark, 16: 23910
FISCHER, P. G., Reactor analysis program for IBM-704, 16: 24935 (DC-61-2-97)
FISCHER, P. U., Reactor shutdown mechanisms in Peach Bottom HTGR, 16: 24519
FISCHER, R., Luminescence of glass by γ radiation, 16: 23754
FISHER, A., Dehydrocyclization of 2,2-dimethyl-4-(methyl-C^{14})-pentane, 16: 23565
FISHER, D. J., Flame spectrophotometer, 16: 23617 (TID-7629(p.31-41))
FISHER, D. L., Reversed field heating in thetatron, 16: 24886 (CLM-R-19)
FISHER, Edwin L., Nuclear debris in precipitation, 16: 23985 (NYO-9532)
FITCH, V. L., Particle production by protons, 16: 24858
FITE, L. E., Computer-coupled, automatic activation analysis, 16: 23632 (TID-7629(p.221-38))
FITE, W. L., Charge transfer in collisions, 16: 24780 (GA-2783)
FITE, W. L., Ion-neutral collisions in afterglow, 16: 24276 (GA-2824)
FIZZOTTI, C., Uranium alloys containing Mo and C, 16: 24150 (CNEN-113)
FLATT, H. P., COLLOREK—code for reactor kinetics calculations, 16: 24541
FLEISCHHEIMER, Joan, Activities of radioisotopes, 16: 23712 (NP-11744)
FLETCHER, W., Determination of trace impurities in U compounds, 16: 23636 (TID-7629(p.276-84))
FLETCHER, W., Spectroscopy for determination of U-235, 16: 23616 (TID-7629(p.22-30))
FLIEDNER, T. M., Changes in bone marrow following body irradiation, 16: 23429 (BNL-5032)
FLINN, W. S., Control and transients of self-pressurized water reactors, 16: 24532
FLORES, Jorge Merlo, Excitation function of $Al^{28}(d,p)Al^{29}$, 16: 24785 (NP-11748)
FLORIN, R. E., Gamma irradiation of fluorocarbon polymers, 16: 23707 (ARL-62-350)
FLOSSER, P. R., Proton recoil energy loss distribution, 16: 24791 (ORNL-3089)
FLYGARE, J. Kenneth, Jr., Determination of Ra-226 and Th-230, 16: 23383 (TID-7616(p.147-75))
FLYNN, A. W., Control method and reflector materials, 16: 24487
FLYNN, K. F., Positron emission in decay of K-40, 16: 24856
FLYNN, K. F., Ratio of symmetric to asymmetric fission for U-235, 16: 24347
FODOR, Miklos, Chemical processing of U in Hungary, 16: 23795
FOELDES, Peter, Chemical processing of U in Hungary, 16: 23795
FOELSCHE, Trutz, Radiation doses in space, 16: 24013 (NASA-TN-D-1267)
FOGAGNOLO, G., Determination of flux/ev with Au foil detectors, 16: 23841 (CEA-2162)
FOLEY, R. T., Surface films in lubrication, 16: 23803 (R60GL185)
FONER, S. N., ESR of alkali atoms in inert-gas matrices, 16: 23702
FONG, R., Relativistic quantum mechanics and field theory. II., 16: 24915 (NP-11612(Vol.II))
FONTENILLE, J., Alpha spectrometry using junction detectors, 16: 23840 (CEA-2138)
FOOSE, R. M., Earth deformation from nuclear detonation in salt, 16: 23357 (PNE-109F)
FORD, J. F., Dehydrocyclization of 2,2-dimethyl-4-(methyl-C^{14})-pentane, 16: 23565
FORESTER, D. W., Diffusion of slow electrons in gases, 16: 24325
FORSBERG, Hans G., Liquid scintillation measurements, 16: 24337
FORSYTH, R. S., Determination of burnup, 16: 23627 (TID-7629(p.166-76))
FORWARD, Frank A., Production of UO_2, 16: 23777
FOSTER, B. E., Absorption by concrete of x and γ rays, 16: 24223
FOSTER, Charles Vernon, Heat transfer by free convection, 16: 23824
FOSTER, G. G., low Measurements of UO_2–D_2O lattices, 16: 24427
FOULKE, Larry Ray, KSU pile standardization, 16: 24761 (TID-15667)
FOWLER, William A., Nucleosynthesis in early solar history, 16: 24658
FRANCOIS, B., Use of wet H_2 as sintering atmosphere, 16: 24102 (EURAEC-57(App.5))
FRANK, Richard B., Liquid scintillation counter design, 16: 23920
FRANKEL, Robert, Prog. rpt. on fall-out program, 16: 24012 (HASL-127)
FRANKENTHAL, S., Orbit models for a plasma, 16: 24892
FRANKLIN, C. K., Irradiation-induced property changes in Ta, 16: 24639
FRANKLIN, E. W., High-temperature x-ray diffraction technology, 16: 23837 (ARL-62-315)
FRANKLIN, R., Determination of trace impurities in U compounds, 16: 23636 (TID-7629(p.276-84))
FRANKLIN, R., Spectroscopy for determination of U-235, 16: 23616 (TID-7629(p.22-30))
FRANZINI, Paolo, Mott scattering of polarized muons, 16: 24747
FRAUENFELDER, Hans, Mossbauer effect, 16: 24655
FRAZIER, Virginia L., Selected accessions, 16: 24111 (NP-11825)
FREAS, D. G., Meltdown studies of irradiated nuclear fuel, 16: 24642
FREEMAN, J. L., Prog. rpt. on radioisotopes in coal research, 16: 24035 (NYO-9851)
FRENNET, A., Elementary carbon exchange, 16: 23576
FRESHLEY, M. D., Irradiation testing of Pu fuel element at Hanford, 16: 24640
FRIEDEMAN, H. C., Bibliography on effects of high pressures on materials, 16: 24115
FRIEDLAND, S. S., Detectors for space spectrometry, 16: 23928
FRIEDLANDER, M. W., Prog. rpt. on cosmic radiation, 16: 24660 (AROD-2774:2)
FRIEND, James P., Prog. rpt. on Project Star Dust, 16: 23407 (DASA-1302)
FRITZE, K., Half lives of Ca-141, Ca-142, and Ca-143, 16: 24813
FROEHLICH, F., Increase of F-center formation by x irradiation of KCl, 16: 23765
FROMAGEOT, P., Preparing sulfurated substances, 16: 23561
FROST, K. J., Detector for γ-ray astronomy experiment, 16: 23926
FROWNFELTER, C. R., Prog. rpt. on ultrasonic welding, 16: 24130 (AD-271377)
FRYNTA, E., Radioisotopic control of wear on bearings, 16: 24037 (AEC-tr-5189)
FUCHS, H., Photoneutrons from $C^{13}(\gamma,n)C^{12}$ and $O^{18}(\gamma,n)O^{17}$, 16: 24864
FUDGE, A. J., Determination of burnup, 16: 23626 (TID-7629(p.152-65))
FULTON, George P., Prog. rpt. on effects of radiation on adrenocortical tissue, 16: 23417 (TID-16122)
FUNSTEN, Herbert O., Discrimination in p-n junction detectors, 16: 23901 (PUC-1962-69)
FURNO, Aldo L., Hazards in use of liquid H in bubble chambers, 16: 24015 (TID-15985)
FUTORYANSKAYA, E. L., Determination of Nb, 16: 23659

G

GABRELLI, L., Performances of fast-response photomultipliers, 16: 23865
GAFFEY, C. T., Bioelectric effects of radiation on nerve, 16: 23486 (UCRL-9799)
GAGNAIRE, J., Accumulation of radioelements in plant tissue, 16: 23406 (CEA-2131)
GAILLEDREAU, C., Effect of column length on Sr-90 removal, 16: 25051 (TID-7628(p.211-13))
GAL, D., Oxidation of mercaptoacetic acid, 16: 23566
GALKIN, N. P., Reduction of U oxides and UO_2F_2, 16: 24187
GALLAGHER, J. D., Whole-body scintillation counters, 16: 23875
GALLAGHER, J. M., Jr., CVTR controlled plant study, 16: 24972 (CVNA-136)
GALLAGHER, Joseph G., Potential of fully enriched UO_2–SS reactor cores, 16: 24477
GALLEY, John E., Deep-well disposal, 16: 25057 (TID-7628(p.347-55))
GALLINA, V., Three-body Green's function for S-states, 16: 24733
GAMBOU, F., Reaction $Si^{28}(n,\alpha)Mg^{25}$, 16: 24846
GANNON, L. J., MUFT revision—fast neutron spectrum code for IBM-650, 16: 24092 (IDO-16735)
GANT, Preston, Preparation of T-labeled olefins, 16: 24581
GARABEDIAN, H. L., Analytic approach to two-dimensional reactor theory, 16: 24399
GARDINER, Donald A., Design for BeO irradiation experiments, 16: 24243 (ORNL-3310)
GARIF'YANOV, N. S., Spin-lattice relaxation time in supercooled solutions of Ti^{3+}, 16: 23703
GARRISON, J. D., Nuclear data for GAM-I data tape, 16: 24088 (GA-2451 (Vol.II))
GASPAR, E., Radiations in purifying used waters, 16: 24054
GAST, R. C., Doppler broadened resonance absorption, 16: 24439
GASTEIGER, Edgar L., Action potential change by β irradiation, 16: 23504
GATES, J. E., Meltdown studies of irradiated nuclear fuel, 16: 24642
GAUS, H., Diffusion of radioactive gases. II., 16: 23763
GAZAZYAN, E. D., Electron beam grouping, 16: 24875
GELSEMA, E. S., Scattering of pions on C and O, 16: 24720
GENTHE, W. K., Mass flow technique using radioisotopes, 16: 24580
GEORGE, D'Arcy R., Recovery of U from ore, 16: 23771 (ACCO-24)
GEORGE, J., Radiation effects on thyroid function, 16: 23431
GEORGE, W. H. S., Separation of Sr from milk and protein, 16: 23654
GEORGIU, Z., Neutron cross sections of As, Se, Sb, and Te, 16: 24811
GERBER, G., Creatine synthesis after x irradiation, 16: 23463
GERBER, G. B., Creatine synthesis after x irradiation, 16: 23463
GERCKE, R. H. J., Coolant decomposition and makeup costs for organic reactors, 16: 24457
GERLACH, H., Radioisotopes for nondestructive material testing, 16: 24067
GETHARD, P. E., Steady-state release of Kr and Xe fission products, 16: 24628
GEVANTMAN, L. H., Self-radiation oxidation of H-3, 16: 23717 (USNRDL-TR-565)
GEYER, John C., Land burial of radioactive wastes, 16: 25062 (TID-7628 (p.396-427))
GHANEM, N. A., Labeling of organic compounds, 16: 23551
GHEMI, F., Human pulmonary circulation, 16: 23395
GIACOMELLI, G., Beta decay of negative muon, 16: 24725
GIBBONS, D., Computer-coupled, automatic activation analysis, 16: 23632 (TID-7629(p.221-38))
GIBSON, E. D., Yttrium, 16: 24201 (IS-222)
GIERULA, Jerzy, Interactions of nucleons with heavy nuclei, 16: 24662 (PAN-291/VI)
GIFFORD, Frank A., Jr., Graphs for atmospheric dispersion, 16: 23986 (ORO-545)
GIGER, G. A., Solid scintillators, 16: 24291
GILBERT, D. I., Effects of space radiation of startup of orbiting reactors, 16: 24547
GILLES, Paul W., High-temperature chemistry, 16: 23677
GILLESPIE, Arthur S., Jr., Radiometric technique for determination of O in waters, 16: 24577
GILROY, John, Scintillation spectrometer for high altitudes, 16: 23923 (UAC-6125)
GLASIER, L. F., Jr., Properties of W, Ta, and Mo, 16: 24162 (NP-11650)
GLASS, I. I., High-speed spark camera, 16: 23852 (UTIA-TN-26)
GLENDENIN, L. E., Positron emission in decay of K-40, 16: 24856
GLENDENIN, L. E., Ratio of symmetric to asymmetric fission for U-235, 16: 24347
GLOVER, Rolfe E., III, Electric and magnetic properties, 16: 24142 (AD-270673)
GLUCK, P., Calibration of isotopic neutron source, 16: 24570
GNADT, P. A., In-pile gas-cooled unclad fuel element test facility, 16: 24643
GNADT, P. A., In-pile gas-cooled fuel test facility, 16: 24950 (ORNL-TM-250)
GNESIN, B. Ya., Icebreaker "Lenin" in Arctic, 16: 25008
GODNEV, I. N., Combined effect of radiation and catalyst, 16: 23724 (AEC-tr-5153)
GOEDDEL, W. V., Preparation of graphite matrix fuel compacts, 16: 24119 (GAMD-2221)
GOEL, Parmatma S., Cosmogenic C-14 and Cl-36 in meteorites, 16: 23984 (NYO-8922)
GOETZ, L. J., Pyrolytic carbon coating of ceramic fuel, 16: 24626
GOETZE, G. W., Secondary emission for high-speed counting, 16: 23809
GOL'DANSKII, V. I., Effect of radiation on Teflon and other polymers, 16: 23720 (AEC-tr-5144)
GOLDBERG, Eugene, Effect of resonance scattering on Co absorption integral, 16: 24433
GOLDBERG, G., Determination of oxides and nitrides in salts and metals, 16: 23638 (TID-7629(p.295-307))
GOLDEN, Girard Edward, Fluid flow phenomena in tube boilers, 16: 23825
GOL'DIN, L. L., Design of 7-Bev proton synchrotron, 16: 24872
GOLDMAN, A. E., Beryllium-sheathed UO_2 fuel element irradiation, 16: 24613
GOLDMAN, Arthur J., Temperature transients in fast reactor power excursion, 16: 24501
GOLDSACK, S. J., Meson production in H, 16: 24719
GOLDSCHMIDT-CLERMONT, Y., Hyperon and kaon production, 16: 24737
GOLDSTEIN, H., Flux depression in foils, 16: 24362
GOLDSTEIN, Herbert, Neutron leakage and absorptions in $MnSO_4$ bath, 16: 24432
GOLDSTEIN, Rubin, Resonance absorption of neutrons. II., 16: 24390
GOLE, C. V., Tracer studies of Bombay harbor, 16: 24002
GOLUB, M. A., Reaction of polyisoprene and polybutadiene with S, 16: 23538
GOLUB, William A., Pressure drop review for NCR, 16: 23819 (KAPL-M-WAG-1)
GONTAR', M. A., Effect of cooling on austenite, 16: 24197
GONZALEZ, L., Neutron reactions (n,p) and (n,γ), 16: 24787 (NP-11791)
GOOD, R. H., Jr., Foldy-Wouthuysen and Lorentz transformations, 16: 24736
GOODALL, G. C., Determination of trace impurities in U compounds, 16: 23636 (TID-7629(p.276-84))
GOODJOHN, A. J., Analysis of BeO moderated cores containing H. I., 16: 24411
GOODJOHN, A. J., Analysis of BeO moderated cores containing H. II., 16: 24412
GOODJOHN, A. J., Nuclear data for GAM-I data tape, 16: 24088 (GA-2451 (Vol.II))
GOODYEAR, Robert S., Thermistors, 16: 23974 (ANL-6515(p.187-201))
GORDON, Glen E., Spallation-fission competition in At, 16: 24854
GOREN, S., Determination of Te in presence of Bi, 16: 23602 (IA-639)
GORIN, E., Prog. rpt. on radioisotopes in coal research, 16: 24035 (NYO-9851)
GORMLEY, M. F., Analysis of critical experiments, 16: 24409
GORSHENINA, T. I., Relationship of localization of radiation affection to functional state of organ. III., 16: 23436
GORTON, H. Clay, Semiconductors as radiation detectors, 16: 23870
GOSSER, R. B., Ultrasonic cw spectrometer, 16: 23950
GOSZTONYI, Thomas, Preparation of C-14 tetrazolium salts, 16: 23855
GOUJON, Paul, Heavy water analyzer, 16: 23623 (TID-7629(p.91-109))
GOULDEN, P. V., Fuel assembly handling, EGCR, 16: 24989 (TID-6702)
GOURDINE, Meredith C., Magnetohydrodynamic working fluids, 16: 24804 (ASD-TDR-62-259)

GRACHEV, S. A., Synthesis of organic compounds of Po, 16: 23721 (AEC-tr-5149)
GRAFT, Ronald D., Radiation damage in compound semiconductors, 16: 24234 (ARL-62-343)
GRANATKIN, B. V., Diffusion and thermalization of neutrons in water and ice, 16: 24765 (AEC-tr-5143)
GRANDY, G. L., Fission gas release from pebble bed reactor fuel elements, 16: 24627
GRASHCHENKOV, N. I., Response of nervous system to radiation, 16: 23487
GRASSINI, Giuliana, Chromatography of inorganic ions on Zr phosphate paper, 16: 23650
GRAVES, H. W., Jr., Reactivity calculations in Yankee Core I, 16: 24471
GRAVES, H. W., Jr., Reactivity behavior of Yankee Core I, 16: 24472
GRAVES, W. E., Bucklings and void effects in D_2O–UO_2 lattice, 16: 24414
GRAY, Peter V., Transverse magnetic coefficients K(y) and L(y), 16: 23835 (AFOSR-2665)
GRAZIANO, William, Reactions $K^- + p \rightarrow K + N + (\pi)$ at 1.15 Bev/c, 16: 24701 (UCRL-10126)
GRECOV, D., Optimum input temperature of reactor coolant, 16: 25005
GRECOV, D., Reheating temperature of feed water, 16: 25006
GREEBLER, Paul, Excursion shutdown mechanism, 16: 24518
GREEN, F. L., Analysis of Si in cast Fe, 16: 24573
GREEN, F. L., Ytterbium-169 for industrial radiography, 16: 24584
GREEN, Farno L., Determination of Si in Al alloy, 16: 24574
GREEN, Farno L., Photon emission from radioisotopes, 16: 24583
GREEN, Farno L., Surface composition based on nuclear bombardment data, 16: 24569
GREEN, Harry M., Irradiation characteristics of beta U, 16: 24632
GREEN, Leon, Reactor coolant properties, 16: 23830 (BNL-5377)
GREEN, R. W., Neutron streaming in HTGR, 16: 24596
GREENSPAN, H. P., MHD viscous flow problems, 16: 24894
GREENSTEIN, Jesse L., Nucleosynthesis in early solar history, 16: 24658
GREENWOOD, G. W., Deformation of U, 16: 24202
GREGORY, Walton C., Efficacy of mutation breeding, 16: 23369
GRENDA, Ronald J., Bubbling two-phase mixture, 16: 24510
GRIFFIN, C. W., Reactor power spectrum measurements, 16: 24538
GRIMANIS, A. P., Determination of As in Cu alloys and organic materials, 16: 24565
GRIMES, Patricia, Effect of deuteron microbeam on mouse lens, 16: 23428 (BNL-6081)
GRIMES, W. R., Corrosion by molten fluorides, 16: 23594
GRIMES, W. R., Reactions in molten fluoride media, 16: 23595
GRIMESEY, R. A., MUFT revision—fast neutron spectrum code for IBM-650, 16: 24092 (IDO-16735)
GRINOCH, P., Thermal radiation measurements, 16: 23855 (WT-544)
GRISHIN, V. G., On charge exchange of π^- mesons, 16: 24685 (JINR-P-928)
GRISON, G., Discharge of radioactive wastes in Inpra, 16: 25074 (TID-7626(p.569-82))
GROMOV, V. F., Copolymerization of acrylonitrile and ethylene by radiation, 16: 23762
GROSS, W. A., Gas film lubrication, 16: 23813
GROTE, C., Inelastic pion-nucleon interactions, 16: 24716
GROTE, C., Inelastic π^--nucleon interactions, 16: 24717
GROTE, C., Inelastic π^--nucleon interactions, 16: 24718
GROTE, C., Inelastic π^--nucleon interactions, 16: 24715
GROVES, Thomas Hoopes, Elastic scattering of Λ hyperons from protons, 16: 24710
GRUND, J. E., Ambient temperature power excursion tests, 16: 24522
GUCZI, L., Oxidation of mercaptoacetic acid, 16: 23566
GUERIN, Henri, Reactivity of nuclear graphites, 16: 23678
GUERRANT, G. C., Fission chamber and preamplifier assembly for high-flux, 16: 24552
GUILBOT, A., Action of γ rays on flour, 16: 24041
GUILLAUME, M., Production of C^{14}-labeled compounds, 16: 23552
GUNST, S. B., Uranium-235 fission-product poison experiments, 16: 24382
GUPTA, V., Resonances (π-σ) and (K-σ), 16: 24734
GUREVICH, V. L., Superconductivity in semiconductors, 16: 24332
GURSKY, Herbert, Ranger study of Po–Be neutron spectrum, 16: 24762 (TID-15743)
GURSKY, J., Energetics of fission reactions, 16: 24350
GUSTAFSON, V. W., Nuclear control characteristics of PRTR, 16: 24537
GUTHRIE, D. G., Determination of burnup, 16: 23627 (TID-7629(p.166-76))
GUTTMAN, Paul H., Renal changes in irradiated mouse, 16: 23453
GUYON, John Carl, Compounds of Ti and Nb, 16: 23680
GUZZLE, T. L., Subcritical experiment for Hallam reactor, 16: 24419
GVOZDEV, B. A., Nuclear reaction $Th^{232}(Ne^{22},4n)Fm^{250}$, 16: 24781 (JINR-P-896)

H

HAAG, D., Photoneutrons from $C^{12}(\gamma,n)C^{11}$ and $O^{16}(\gamma,n)O^{15}$, 16: 24864
HABERER, Klaus, Measurement of small activity concentrations in H_2O, 16: 23868
HADA, Ikei, Acrylonitrile–allyl alcohol copolymeric fibers by γ-induced copolymerization, 16: 23753
HAFFNER, J. W., Instrument for monitoring air-borne Be, 16: 24571
HAFFNER, J. W., Mass flow technique using radioisotopes, 16: 24580
HAGER, H., X-irradiated central nervous system of hamster, 16: 23485
HAHN, R. D., Irradiation behavior of U–C fuels, 16: 24611
HAIDUC, C., Optimum input temperature of reactor coolant, 16: 25005
HAIDUC, C., Reheating temperature of feed water, 16: 25006
HAMSON, J., Linear accelerators for high-energy x-ray production, 16: 23976 (ANL-6515(p.218-47))
HAIRION, J. P., Thermal conductibility by radial flow, 16: 24104 (EURAEC-57(App.7))
HAKKILA, E. A., Determination of W in Ta, 16: 23619 (TID-7629(p.55-61))
HALEY, Thomas J., Response of nervous system to radiation, 16: 23471
HALIJAK, Charles A., Digital approximation of differential equations, 16: 24652
HALL, V. C., Jr., Steam separation requirements for boiler-superheater reactors, 16: 24969 (CEND-116)
HALLIGAN, E. G., Deep well fluid waste disposal, 16: 25059 (TID-7628 (p.363-73))
HAMMITT, Frederick G., Liquid-metal heat-transfer facility for university use, 16: 24651
HAMMOND, Carolyn W., Phagocytin from x-irradiated rabbits, 16: 23462
HANAUER, S. H., Fission chamber and preamplifier assembly for high-flux, 16: 24552
HAND, Louis Neff, Production of π mesons, 16: 24707
HANDWERK, J. H., Sintering of UC from liquid metal media, 16: 24629
HANKEL, R. D., Evaluation of fast U^{233}–Th breeder reactors, 16: 24478
HANNA, G. C., Flux perturbations—measurements, 16: 24359
HANNA, J., Neutrons from reaction $Be^9(\alpha,n)C^{12}$, 16: 24852
HANSEN, E. C., Uncertainties in predicted fission-product poisoning, 16: 24385
HARBERTSON, Alan, Determination of Ra-226 and Th-230, 16: 23383 (TID-7616(p.147-75))
HARDCASTLE, Kenneth Irvin, Rare earth–hydrogen systems, 16: 23683
HARDGROVE, B. J., Astronautics information, Vol. V., No. 4, 16: 25032 (NP-11619)
HARDT, Werner, Configuration of DESY magnet, 16: 24870 (UCRL-Trans-816)
HARDY, Edward P., Jr., Prog. rpt. on fall-out program, 16: 24012 (HASL-127)
HARDY, J., Jr., Effective U-238 resonance capture integrals, 16: 24764 (WAPD-T-1497)
HARDY, J., Jr., Effective U-238 resonance capture integral of U and UO_2, 16: 24395
HARNASH, A. H. E., Exchange reactions in aromatic systems, 16: 23562
HARLOW, Harry F., Effects of radiation on central nervous system, 16: 23506
HARMON, M. K., Solvent extraction of irradiated U fuels, 16: 23781 (HW-SA-2458)
HARRINGTON, F. E., Water requirements for radiochemical processing plant, 16: 23790 (ORNL-TM-244)
HARRIS, D. R., Photoneutron source in U–water reactors, 16: 24495
HARRIS, Gordon M., Reactions of inorganic complex compounds, 16: 23581
HARTMAN, John M., Radioactive gas in detection cardiac shunts, 16: 23368
HARVEY, Bernard G., Application of recoil techniques, 16: 24853
HARVEY, E. B., Effects of x radiation on ova, 16: 23416 (TID-16121)
HARWARD, M. E., Determination of sulfate adsorption by soils, 16: 23539
HASHIMOTO, Minoru, Studies on 6-nylon fibers irradiated by γ rays. I.,

16: 24254
HASKIN, John, Radioactive gas in detection cardiac shunts, 16: 23368
HASSELMAN, D. P. H., Thermal shock resistance of ceramic bodies, 16: 24176 (WADD-TR-60-749(Pt.II))
HASSITT, A., Computer program for multigroup diffusion equations, 16: 24763 (TRG-Report-229)
HATTON, J. V., NMR investigation of molecular complexes, 16: 23533
HAUBENREICH, P. N., Safety calculations for MSRE, 16: 24988 (ORNL-TM-251)
HAUG, A., Proton bombardment of Al, 16: 24848
HAUSER, O., E modulus in irradiated Cu, 16: 24261
HAUSNER, H. H., Bibliography on effects of high pressures on materials, 16: 24115
HAWKINS, R. H., Burial of solid radioactive wastes, 16: 25066 (TID-7628 (p.462-8))
HAYAKAWA, Satio, Effect of solar cosmic rays on meteorite radioactivity, 16: 24668
HAYASHI, Koichiro, Radiation polymerization of ring compounds, 16: 23744
HAYMAKER, W., Human tolerance to thermal neutrons, 16: 23495
HAYMAKER, Webb, Changes in brain caused by α particles, 16: 23492
HAYMAN, P. J., Charge ratio of cosmic ray muons, 16: 24669
HEATH, R. L., Scintillation spectrometry, 16: 23914
HEATHERTON, R. C., Depth dose from Pa-234 β rays, 16: 23378 (TID-7616(p.79-88))
HEATHERTON, R. C., Removal of suspended solids in process wastes, 16: 23385 (TID-7616(p.223-34))
HEDLEY, W. H., Production of UO_2, 16: 23773 (MCW-1470)
HEDMANN, Sven, Fuel composition for homogeneous reactors, 16: 24953 (AEC-tr-5165)
HEFFNER, R. E., Failure of Spert-III pressurizer vessel, 16: 24490
HEGER, Adolf, Modification of fibers by radiation. II., 16: 24250
HEINEMAN, R. E., Reactor parameters in U–graphite lattices, 16: 24356
HEJLEK, Radoslav, Radioisotope labs. in Czechoslovakia, 16: 23809
HEJTMANEK, Hans, Energy-dependent neutron transport problem, 16: 24769 (AEC-tr-5204)
HELLER, Adam, Efficiencies of organic liquid scintillators, 16: 23884
HELLER, H. A., Determination of Zr in U materials, 16: 23621 (TID-7629(p.69-80))
HELLER, H. A., Determination of Zr in U, 16: 23655
HELLSTRAND, E., Resonance absorption of U metal and oxide, 16: 24759 (AE-77)
HELLWEGE, K. H., Electronic energy levels and radiation of atoms in crystals, 16: 24290 (UCRL-Trans-399(L))
HELM, Friedrich H., Neutron scintillators, 16: 24327
HELTEMES, Eugene Casmir, Heat capacity of solid He-3, 16: 23689
HEMPLE, H. Dieter, Scintillation measuring equipment, 16: 23946
HENDEE, C. F., Electron multipliers utilizing continuous strip surfaces, 16: 23890
HENDERSON, E. H., Barium in bones and foodstuffs, 16: 23370 (AERE-R-4035)
HENDRICKSON, Frank R., Incorporation of tritiated thymidine into DNA, 16: 23367
HENRIE, J. O., Magnetite Fe ore concrete for nuclear shielding, 16: 24230
HENRIE, James O., Properties of nuclear shielding concrete, 16: 24222
HENRY, A. F., Synthesis approximations in time direction, 16: 24543
HENRY, Julian, Changes in brain caused by α particles, 16: 23492
HENRY, K. M., Measurement of spectral density of reactor power fluctuations, 16: 24549
HENRY, R., Synthesis of iodized organic compounds, 16: 23559
HENSHAW, Paul S., Changes in nervous system induced by radiations, 16: 23497
HERBST, W., Radioactivity in dust and rain, 16: 24006
HERD, J. A., Myocardial blood flow determined with Kr-85, 16: 23362
HERR, W., Breaking chemical bonds in bromo- complexes by isomeric transitions, 16: 23764
HERRMANN, J., Preservation of vegetables by radiation, 16: 24059
HERRMANN, Josef, Preservation of foods with ionizing radiation, 16: 24040
HESS, Allen L., Critical studies for Enrico Fermi Reactor Core B, 16: 24410
HETER, Adolf, Modification of fibers by radiation. I., 16: 24249
HETTINGER, Gunnar, Spectra of scattered radiation behind slabs of water, 16: 24293
HEUCKROTH, L. E., High-speed spark camera, 16: 23852 (UTIA-TN-20)
HIBBARD, L. U., Large homopolar generator, 16: 24877
HIBINO, C., Problems with γ-ray level control system in bleaching tower, 16: 24063
HICKS, Samuel P., Radiation of developing nervous system, 16: 24358
HIDE, R., Design of shock tube, 16: 24275 (CLM-R-18)
HIEBERT, R. D., Whole-body liquid scintillation counters, 16: 23875
HIKIDO, K., Conceptual design of Mixed Spectrum Superheater, 16: 24472
HILD, W., Principles of ion exchange, 16: 23575
HILL, David C., Behavior in water of UO_2 core, stainless steel-304 clad fuel pins, 16: 24617
HILLENDAHL, R. W., Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
HILLIG, O. R., Hallan exponential lattices containing UC fuel elements, 16: 24984 (NAA-SR-Memo-7134)
HILLIG, O. R., Subcritical experiment for Hallan reactor, 16: 24419
HILLYER, J. C., Organic coolant research, 16: 25018 (IDO-16761(p.1-74))
HILLYER, J. C., Out-of-pile electron irradiation circulating loop, 16: 24469
HILSMEIER, William F., Graphs for atmospheric dispersion, 16: 23986 (ORO-545)
HINMAN, G. W., Accurate computation of Doppler broadening, 16: 24393
HINTENBERGER, H., Meteorites with high noble gas content. II., 16: 23999
HINTENBERGER, H., Primordial rare gases in meteorite Breitscheid, 16: 23998
HIPPE, Zdzislaw, Influence of γ radiation and neutrons on lacquer coatings, 16: 24263
HIRAI, Tadaaki, Polymerization of polyethylene by γ rays, 16: 23718 (AEC-tr-4321)
HIRANADANI, M. G., Tracer studies of Bombay harbor, 16: 24002
HIRANO, Kan-ichi, Diffusion in Co–Ni alloys, 16: 24169 (NYO-9430)
HIRLING, Jozsef, Remote handling device for isotopes, 16: 23808 (FTD-TT-62-530)
HIRSCHBERGER, W., X-irradiated central nervous system of hamster, 16: 23485
HIRSCHBERGER, Wolfgang, Effects of x rays on central nervous system, 16: 23482
HIRSCHFIELD, J., Activation analysis for materials testing, 16: 23864 (ANL-6515(p.9-27))
HIRSCHMAN, A., Thermal radiation measurements, 16: 23855 (WT-544)
HISKES, John R., Injection into fusion machines using Lorentz force, 16: 24446
HODGE, Webster, Beryllium for structural applications, 16: 24096 (DMIC-168)
HOEHLE, R., Apparatus for γ activity comparison with ionization chamber, 16: 23866
HOFFMAN, T. A., Reactor analysis program for IBM-704, 16: 24935 (DC-61-2-97)
HOFFMANN, Tibor, Contamination from stack of reactor, 16: 25079
HOFFMANN, Tibor, Overheated solid state in reactors, 16: 24309
HOFSTRA, Diane, Immunologic unresponsiveness during secondary disease of irradiated mice, 16: 23521
HOLLADAY, W. G., Lepton conservation using isotopic displacement 16: 24742
HOLLADAY, W. G., Selection rules for $N\bar{N}$ annihilation, 16: 24735
HOLLAND, L. K., Scheduling computer system for Big Rock Point Plant, 16: 24545
HOLLANDER, L., Platelets transfused into thrombocytopenic recipients, 16: 23526
HOLLENBERG, M., Myocardial blood flow determined with Kr-85, 16: 23362
HOLLISTER, William L., Bibliography on radiation effects on electronic components, 16: 24241 (NP-11852)
HOLLOWAY, A. F., Scattering of γ rays off concrete, 16: 24911
HOLM, L. W., Ion exchange of lanthanide and actinide systems, 16: 23871
HOLMES, P. D., Dehydrocyclization of 2,2-dimethyl-4-(methyl-C^{14})-pentane, 16: 23565
HOLT, Smith L., Preparation of T-labeled olefins, 16: 24581
HOLTEBEKK, T., Proton bombardment of Al, 16: 24848
HOLTZ, F. C., Prog. rpt. on Zr alloys, 16: 24117 (ARF-2198-28)
HOLYNSKI, Roman, Interactions of nucleons with heavy nuclei, 16: 24687

(PAM-291/VI)
HOMEYER, W. G., Materials and energy recovery in fusion reactors, 16: 24447
HOMEYER, W. G., Tritium regeneration in fusion reactors, 16: 24448
HOMMEL, Carleton O., Application of radioactive clathrates to gas monitoring, 16: 24576
HONDA, Tsuyoshi, Heavy-particle-stripping reaction. I., 16: 24838
HONDA, Tsuyoshi, Heavy-particle-stripping reaction. II., 16: 24839
HONECK, Henry C., Incoherent thermal scattering model for D_2O, 16: 24379
HONES, E. W., Jr., Spectrometer to search for positrons in space, 16: 23924
HOOGENBOOM, A. M., Nuclear energy levels in P-29*, 16: 24795 (TID-15331)
HOOKER, R. J., Main propulsion "steamotor", 16: 23798 (AD-269390)
HOPKINS, G. R., TRIGA shutdown mechanism, 16: 24520
HOPKINS, H. C., Jr., Irradiation of 19-rod bundle fuel element, 16: 24637
HORN, F. L., "Phosfluor" process for reprocessing ceramic fuels, 16: 24645
HORST, K. M., Comparative study of fuel in Na-cooled fast reactor, 16: 24480
HORST, K. M., Core design for 500-Mwe fast oxide reactor, 16: 24479
HORWOOD, J. L., Determination of U, 16: 23604 (NP-11873)
HOSAIN, F., Study on Fe turnovers, 16: 23391
HOSAIN, P., Study on Fe turnovers, 16: 23391
HOUGH, Paul V. C., Computer learns to see, 16: 24087 (BNL-725)
HOUSER, Fred N., Geology of tunnels, Nevada Test Site, 16: 23988 (TEI-817)
HOUSTON, D. H., Low-energy neutron spectra in D_2O and H_2O, 16: 24366
HOVEKE, G. F., Heavy water reactor plant leakage, 16: 24499
HOWARD, J. E., Control rod worth in Yankee, 16: 24469
HOWARD, J. E., In-core instrumentation in Yankee Core I, 16: 24470
HOWARD, J. E., Reactivity behavior of Yankee Core I, 16: 24472
HOWARTH, L. E., Far infrared dielectric dispersion in titanates, 16: 24321
HOWLAND, J. W., Late manifestations of body radiation, 16: 23419 (UR-609)
HOWLETT, B. W., Liquid metal solution calorimeter, 16: 23949
HOY, R. B., Earth deformation from nuclear detonation in salt, 16: 23357 (PNE-109F)
HOYLE, Fred, Nucleosynthesis in early solar history, 16: 24658
HU, Yao-cheng, Radiochemical determination of K, 16: 23647
HUANG, Justin Chi Ching, Strange particle production, 16: 24711
HUBBARD, E. L., Nuclear particle spectrometers for satellites, 16: 23922
HUBBARD, Robert LeRoy, Vibrational force fields in deuteroethanes, 16: 243.3
HUBNER, R. S., APWRC-GAMICO—modification of GAM-I for PWR, 16: 24945 (BND-C-2500-5)
HUCKS, J. S., Steam separation requirements for boiler-superheater reactors, 16: 24969 (CEND-116)
HUDDLESTON, C. M., Differential dose albedo for γ rays on concrete, 16: 24599
HUDSON, P. S., Organic coolant research, 16: 25018 (IDO-16761(p.1-74))
HUDSON, P. S., Out-of-pile electron irradiation circulating loop, 16: 24460
HUDSON, R. G., Prog. rpt. on carbides for thermionic space reactors, 16: 24154 (GA-3245)
HUDSON, R. P., Relaxation in rare earth double nitrates, 16: 24313
HUEPER, Rolf, Quantum theory with indefinite metric, 16: 24928
HUGHES, M. J., High-temperature lubrication, 16: 23802 (NP-11683)
HUIZENGA, J. R., Measurements of Cu(p,n) cross sections, 16: 24793 (TID-12696)
HULL, Harold Legrande, Flow across unbaffled tube banks, 16: 23826
HULSIZER, Robert, SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)
HULTBERG, Sooive, K-shell photoelectric cross sections, 16: 24294
HULUBEI, H., Thermal columns for amplifying fluxes in water-moderated reactors, 16: 24955
HUMPHERYS, Kent C., Neutron flux and spectra measurements in reactor, 16: 23377 (TID-7616(p.69-77))
HUMPHREY, R. M., Effect of x radiation on plasma Fe, 16: 23430
HUNT, E. L., Stimulation of nervous system with ionizing radiation, 16: 23420 (USNRDL-TR-561)
HUNTER, D., Control rod worth in Yankee, 16: 24469
HUNTER, D., In-core instrumentation in Yankee Core I, 16: 24470
HUNTINGTON, C. W., Measurement of low-surface-area U compounds, 16: 23640 (TID-7629(p.331-44))
HUNTLEY, W. R., In-pile gas-cooled unclad fuel element test facility, 16: 24643
HUNTLEY, W. R., In-pile gas-cooled fuel test facility, 16: 24950 (ORNL-TM-250)
HUPKA, Stefan, Types of γ detectors. I., 16: 23941
HURE, J., Separation of Zr and Hf, 16: 23792 (AEC-tr-5099)
HURSH, John B., Lung model, 16: 23382 (TID-7616(p.133-46))
HURST, G. S., Radiation in shelters and instrumentation, 16: 24016 (WT-789)
HUTCHINS, B. A., Comparative study of fuel in Na-cooled fast reactor, 16: 24480
HUTCHINS, B. A., Core design for 500-Mwe fast oxide reactor, 16: 24479
HUTH, Gerald C., Effect of γ radiation on insulating materials, 16: 24244 (TID-15981)
HWA, Jesse C. H., Measurements on the degree of crosslinking, 16: 24196
HYLAND, R. F., Symbols for instrument flowsheets and drawings, 16: 23353 (CF-57-2-1(Rev.1))

I

IBRAHIM, Mohammed, Binary system CaO–Nb_2O_5, 16: 24191
IERNETTI, G., Performances of fast-response photomultipliers, 16: 23865
IGNATENKO, A. E., Anomalies in μ^- meson decay in mesoatoms, 16: 24278 (JINR-P-971)
IGNATENKO, V. P., Compensation of ion space charge by electrons, 16: 24288 (FTD-TT-62-317)
IMPINK, A. J., Jr., Materials and energy recovery in fusion reactors, 16: 24447
IMPINK, A. J., Jr., Tritium regeneration in fusion reactors, 16: 24448
IMRE, Lajos, Production of carrier-free radioisotopes. II., 16: 24080
IMRIS, Pavel, Differential thermal analysis of U_3O_8, 16: 23652
IMRIS, Pavel, Sedimentation of U_3O_8 suspension, 16: 23699
IN, Shou-kun, Radiolysis of polymers, 16: 23745
INAGAKI, Y., Effects of irradiation on polyethylene, 16: 24248
INALL, E. K., Large homopolar generator, 16: 24877
INDREASH, G., Electron load of cyclotron resonator, 16: 24867 (JINR-P-962)
INGALLS, Robert Lynn, Ionic compounds of Fe-57, 16: 23713 (NP-11788)
INGLES, J. C., Determination of U, 16: 23604 (NP-11873)
INGLEY, John Sanford, Lifetime behavior of nonuniform optimized reactors, 16: 24956
INGLIS, D. R., Heavy-particle stripping and N-14 structure, 16: 24851
INGOLD, John H., Diffusion of charged particles in scattering medium, 16: 24676 (APED-3960)
INGOLD, John H., Diffusion of electrons in neutral gas, 16: 24272 (APED-3959)
INNES, J. R. M., X irradiation and delayed myelomalacic, 16: 23483
INSKEEP, C. H., Thin diffused-junction counters, 16: 23898
IONUE, Yoritoru, Injection disposal, 16: 25055 (TID-7628(p.303-23))
IRISH, E. R., Ground waste disposal at Hanford, 1959-61, 16: 25069 (TID-7628(p.491-505))
IRVINE, J. W., Jr., Solvent extraction studies of halides, 16: 23582
IRVING, R., Radiation-resistant lubricants, 16: 24247
ISAAC, Walter, Effects of radiation on behavior and blood, 16: 23511
ISAEV, B. M., Production of pure fast-neutron fluxes, 16: 24705
ISAGULYANTS, I. V., Mechanism of catalytic processes, 16: 23568
ISHIDA, Tomotsu, Improvement of dyeing properties of fibers by γ irradiation, 16: 24265
ISRAILEWITSCH, E. A., Isotopic analysis of waters, 16: 23661
ITO, H., Startup transients in boiling water reactors, 16: 24530
IVANOV, F. I., Effect of cooling on austenite, 16: 24197
IVINS, R. O., Sensitivity of pressure transducers, 16: 24554
IVINS, Richard O., Behavior in water of UO_2 core, stainless steel-304 clad fuel pins, 16: 24617
IZYUMOV, Yu. A., Magnetic scattering of slow neutrons, 16: 24333

J

JACKSON, D. P., Platelets transfused into thrombocytopenic recipients, 16: 23526

JACOBS, L. A., Effects of fetal x irradiation in cerebral cortex, 16: 23473
JACOBS, Lewis Lawrence, Photoreactivation of *E. coli*, 16: 23449
JACQUET, Michel, Reactivity of nuclear graphites, 16: 23678
JAECH, J. L., Rupture model for fuel elements, 16: 24937 (HW-70400)
JAKOWLEWA, E. A., Isotopic analysis of waters, 16: 23661
JALICHANDRA, P., PM-3A secondary shielding, 16: 24996 (TID-15477)
JAMISON, D. K., Land burial of radioactive wastes, 16: 25062 (TID-7628 (p.396-427))
JAMISON, Donald K., Conference on ground disposal of radioactive wastes, 16: 25037 (TID-7628)
JAMRON, Richard, Liquid-metal heat-transfer facility for university use, 16: 24651
JANAREK, F. J., Boron-10 diffused junctions in n-type Si, 16: 23903 (UAC-6130)
JANKER, R., Field boundary and scatter radiation, 16: 24026
JANSE, A. R. P., Hood, for work with radioisotopes, 16: 23811
JANSEN, Cornelius R., Lymphopenia produced by irradiation, 16: 23434 (BNL-6011)
JANSSEN, P., Fluorescein as indicator of radiation injury to brain, 16: 23491
JANSSEN, Peter, Changes in brain caused by α particles, 16: 23492
JASANI, B. M., Large area liquid scintillation and Cherenkov counters, 16: 23937
JEDLINSKI, Zbigniew, Influence of γ radiation and neutrons on lacquer coatings, 16: 24263
JELLINEK, F., Tetragonal form of ZrOS, 16: 23676
JEMISON, L. L., Leak testing headlamp units using radioactive gas, 16: 24585
JEN, C. K., ESR of alkali atoms in inert-gas matrices, 16: 23702
JENKINS, F. E., Hydrogen in U metal, 16: 23639 (TID-7629(p.316-27))
JENKINS, W. J., Solid-state α counters in process streams, 16: 23902
JENSEN, J. C., FAD—fuel assembly design program, 16: 24435
JEZOWSKA-TRZEBIATOWSKA, B., Structure of complex compounds, 16: 23570
JOANOU, G. D., GATHER-II—consistent B_1 code for thermal neutron spectra, 16: 24440
JOANOU, G. D., Nuclear data for GAM-I data tape, 16: 24088 (GA-2451 (Vol.II))
JOFTES, David L., Interactions of radiations with biological subsystems, 16: 24557
JOHANNESSON, J. K., Preparation of thin films for 4π beta counting, 16: 23939
JOHANSSON, Lennart, Spectrum of ionized Be II, 16: 24292
JOHNSON, A. A., Point defects in Nb, Mo, and Ta, 16: 24258
JOHNSON, Dennis R., Flux and spectrum measurements in training reactor, 16: 25025 (TID-15977)
JOHNSON, R., "Phosfluor" process for reprocessing ceramic fuels, 16: 24645
JOHNSON, R. H., Deformation of U, 16: 24202
JOHNSON, R. L., Ambient temperature power excursion tests, 16: 24521
JOHNSON, T. R., Sintering of UC from liquid metal media, 16: 24629
JOHNSTON, H. F., Thermal utilization—spatially dependent spectra, 16: 24425
JOHNSTON, Hugh F., Apparatus for pile oscillator experiments, 16: 24550
JOKLIK, Otto F., Production of Plexiglas by radiopolymerization, 16: 24064
JONES, G. A., Measurements of Cu(p,n) cross sections, 16: 24793 (TID-12696)
JONES, H. C., Flame spectrophotometer, 16: 23617 (TID-7629(p.31-41))
JONES, Larry P., Acute central nervous system syndrome of burros, 16: 23498
JONES, Lawrence W., Pion-pion interactions, 16: 24748
JONES, Llewellyn H., Pure rotational spectrum of NT_3, 16: 23698
JONES, Paul H., Geophysical research at NRTS, 16: 25043 (TID-7628 (p.99-114))
JONES, R. J., Publication of AEC measurement methods, 16: 23635 (TID-7629(p.259-66))
JONES, W. M., Angular distributions in $N^{14}(d,p)N^{15}$, 16: 24841
JORDAN, Donald Earl, Equilibrium constants of uranyl ions, 16: 23534
JORDAN, Dunn L., Fertility of mice irradiated with neutrons, 16: 23467
JORDAN, E. D., Material identification by $(n,\alpha\gamma)$ reaction in B, 16: 24572
JOSEPH, Leon, Evaluation of fast U^{233}–Th breeder reactors, 16: 24478
JOVANOVIC, Jovan Vojislava, Polarization of Ne-19 positrons, 16: 24020
JOVANOVIC-KOVACEVIC, Olga, Radioisotopes, 16: 24073
JUHOD, E., Synthesis of iodized organic compounds, 16: 23559
JUST, Richard, Radiation detectors, 16: 23960

K

KADOTA, Hajime, Survival of bacteria irradiated with γ rays. I., 16: 23457
KAESTNER, P. C., GATHER-II—consistent B_1 code for thermal neutron spectra, 16: 24440
KAGANOVE, Arlene S., Carbon dioxide uptake in algae, 16: 23364
KAINE, D., Fast pulse multiplication, 16: 23917
KAISER, David Gilbert, Neutron activation analysis of pharmaceuticals, 16: 23646
KAISER, R. E., Monte Carlo evaluation of fast neutron collimators, 16: 24905 (NAA-SR-Memo-7347)
KAISER, W. C., Response of NaI(Tl) to radiation, 16: 23879
KALABA, Robert, Principles of classical and statistical mechanics, 16: 24295
KALADE, Yu. A., Spin-orbital interactions, 16: 24829
KALBFLEISCH, George R., Pion-pion interaction, 16: 24750
KALFOPULOS, A. F., PM-3A secondary shielding, 16: 24996 (TID-15477)
KALISH, H. S., Melting and casting of UC, 16: 24134 (TID-15337)
KALISH, H. S., Prog. rpt. on nuclear fuel research, 16: 24168 (NYO-2694)
KALLIGA, G. P., Technology of molding Zr objects, 16: 24138
KALMAN, G., Collective modes in plasma due to transverse interaction, 16: 24883 (ARL-251)
KALMAN, G., Statistical distribution of stochastic fields, 16: 24882 (ARL-250)
KALOS, M. H., Fast neutron cross sections, 16: 24796 (UNC-5002)
KALOS, M. H., Flux depression in foils, 16: 24362
KAMBAYASHI, Utako, Extraction of $UO_2(NO_3)_2$ with TBP, 16: 23797
KAMIYA, Yoshiko, Solar magnetic cloud producing cosmic-ray storm, 16: 24667
KAMKE, Detlef, Energy spectrum of fission particles leaving fuel sheet, 16: 24783 (JPL-TR-34-249)
KANCHANALAI, S., Exchange reactions in aromatic systems, 16: 23582
KANE, J. V., First excited states of C-15 and B-10, 16: 24855
KAPLAN, Arthur L., Radiation hazard from water and milk after nuclear attack, 16: 24014 (NP-11715)
KAPLAN, I., Flux distribution in cavity assembly, 16: 24428
KAPLAN, I., Flux distributions in U–D_2O lattices, 16: 24430
KAPLAN, I., Measurements of U-238 capture and fast fission, 16: 24429
KAPLAN, I., Reactor parameters in subcritical and critical assemblies, 16: 24353
KAPLAN, S., Synthesis approximations in time direction, 16: 24543
KAPLAN, Sylvan J., Effects of prenatal radiation on learning, 16: 23507
KARADENIZ, Cemil, Fast neutron spectroscopy, 16: 23934
KARAM, R. A., Prog. rpt. on nuclear properties of Re, 16: 24789 (NP-11874)
KARAM, R. A., Separation of γ pulses from neutron pulses in NaI(Tl) detectors, 16: 245/9
KARGIN, V. A., Structure of polyethylene terephthalate, 16: 23746
KARMYSHEVA, V. Ye., Oocyte maturation in mammalian ovaries in radiation sickness, 16: 23520
KARNAUKHOV, V. A., Nuclear reaction $Th^{232}(Ne^{22},4n)Fm^{250}$, 16: 24781 (JINR-P-896)
KARPOV, V. I., Reduction of U oxides and UO_2F_2, 16: 24187
KARPOV, V. L., Diffusion processes in several polymers. III., 16: 24288
KARRAKER, Robert Herrold, Rare earth-metal chelates, 16: 23684
KARTUSHINSKAYA, A. I., Reactions of Ti(IV)–Ti(III) complexes, 16: 23695
KARZMARK, C. J., Frequency control system for microwave accelerator, 16: 23952
KASHY, E., Nuclear energy levels in P-29 , 16: 24795 (TID-15331)
KASS, S., Corrosion of Zy-2 and Zy-4, 16: 24128 (WAPD-T-1281)
KASTEN, Paul R., Fuel values of Pu and U-233, 16: 24483
KATTCHEE, H., Local film coefficients on ML-1 fuel elements, 16: 24504
KATZ, Joseph J., Carbon dioxide uptake in algae, 16: 23364
KAUFFMAN, Raymond B., Elevation of LD_{50} level in *Planaria*, 16: 23414 (TID-15984)

KAUFMAN, J. L., Fission chamber and preamplifier assembly for high-flux, 16: 24552
KAUFMAN, Warren J., Injection disposal, 16: 25055 (TID-7628(p.303-23))
KAWAMATSU, Syunzi, Polymerization of polyethylene by γ rays, 16: 23718 (AEC-tr-4321)
KAZARINOV, Yu. M., On n-p scattering of 200-Mev neutrons, 16: 24684 (JINR-P-920)
KAZARINOV, Yu. M., Phase analysis of nucleon-nucleon scattering, 16: 24687 (JINR-P-944)
KAZARINOV, Yu. M., Phase analysis of nucleon-nucleon scattering, 16: 24692 (JINR-P-970)
KAZARNOVSKII, M. V., Properties of Van Hove pair correlations function, 16: 24766 (AEC-tr-5146)
KEATEN, R. W., Analysis of power ramp measurements, 16: 24529
KEATEN, R. W., Fuel rod bowing in SRE, 16: 24536
KEATEN, R. W., Measurement of dynamic temperature coefficients, 16: 24542
KECKI, Zbigniew, Radiation yields in two-phase system of O_2(g)–H_2O, NaOH, Na_2SO_4(l), 16: 23716 (PAN-290/ChR)
KEEFE, T. J., Hydrogen in U metal, 16: 23639 (TID-7629(p.316-27))
KEENAN, Thomas K., Purification of Am, 16: 23696
KEIL, K., Meteorites with high noble gas content. II., 16: 23999
KEITH, M. C., Synthesis of methyl 3-O-α-d-glucopyranosyl-C^{14}-β-d-xylopyranoside, 16: 23556
KEKELIDZE, N. P., Germanium monocrystals irradiated with slow neutrons, 16: 24245 (AEC-tr-5147)
KELER, E. K., Effects of Fe_2O_3 on Zr sintering, 16: 24203
KELLEY, M. R., Flame spectrophotometer, 16: 23617 (TID-7629(p.31-41))
KELLMAN, Simon, Effect of resonance scattering on Co absorption integral, 16: 24433
KELLNER, H., Yvon approximation method, 16: 24770
KEL'MAN, E. V., Scattering by ionic impurities in Bi_2Te_3, 16: 24213
KELSALL, Thomas, Solar proton impact zones, 16: 24661 (NASA-TN-D-1291)
KEMP, S. N., Critical experiments on PWR core mockups, 16: 24413
KENDALL, James M., Jr., Compressible viscous vortex, 16: 23818 (JPL-TR-32-290)
KEPES, J. J., Use of Gd septa in slab cores, 16: 24422
KERNICLE, H. A., Nitrogen adsorption-desorption measurements, 16: 23641 (TID-7629(p.345-56))
KERN, R. S., EOCR experimental projects, 16: 25019 (IDO-16761(p.75-97))
KERN, W., Electrostatic filter for radioactive aerosols, 16: 24021 (CEA-tr-A-1002)
KERNS, Quentin A., Photomultiplier single-electron statistics, 16: 23893
KERNS, Quentin A., Time resolution of counter system, 16: 23915 (UCRL-9976)
KERR, B. A., Calculational models of diffusion length, 16: 24373
KERWICK, W., Analysis of Si in cast Fe, 16: 24573
KHAMRAD, V., Homogeneous reactor with suspended fuel, 16: 25003 (AEC-tr-5198)
KHARETCHKO, X., Effects of fetal x irradiation in cerebral cortex, 16: 23473
KHOMKOVSKII, P. M., Copolymerization of acrylonitrile and ethylene by radiation, 16: 23762
KHRUSHCHEV, V. G., Utilization factor of γ irradiation facilities, 16: 24246
KIEHLE, William D., Radiographic sensitivity, 16: 23969 (ANL-6515 (p.102-16))
KIKUCHI, T., Beta decay of negative muon, 16: 24725
KIKUCHI, Tadashi, Beta decay of μ meson, 16: 24712
KILNER, A. Edward, Dieldrin labeled with C-14, 16: 23554
KIMELDORF, D. J., Stimulation of nervous system with ionizing radiation, 16: 23420 (USNRDL-TR-561)
KIMELDORF, Donald J., Radiation-conditioned behavior, 16: 23510
KIMES, T. F., Computation of reactor thermal transients, 16: 24442
KINGERY, W. D., Implications of sintering theories, 16: 24116
KINGTON, J. D., Manganese bath measurements of η of Pu-239, 16: 24431
KINSER, H. B., Separation of transuranium elements from rare earths, 16: 24344
KINSEY, R. J., Analysis of Si in cast Fe, 16: 24573
KIRCHER, J. F., Calibration of isotopic neutron source, 16: 24570
KIRK, W. W., Corrosion of Zy-2 and Zy-4, 16: 24128 (WAPD-T-1281)
KIRN, F. S., Sensitivity of pressure transducers, 16: 24554
KIRSTEN, Frederick A., Automatic testing and nuclear physics experiments, 16: 23918 (UCRL-9982)
KISS, Istvan, Moderating parameters of "Douthern A", 16: 24774
KISTLER, V. E., Calculations of a multispectrum critical assembly, 16: 24406
KISTLER, V. E., Reactivity measurements in AETR, 16: 24407
KITANISHI, Yasuhisa, Radiation polymerization of ring compounds, 16: 23744
KIUCHI, Hiroshi, Polymerization of acrylonitrile in aqueous solution, 16: 23737
KJELLMAN, J., Neutron angular distributions from Be^9(p,n)C^{13}, 16: 24804
KKHOL', F., Radioisotopic control of wear on bearings, 16: 24037 (AEC-tr-5189)
KLABUHN, J., Inelastic π^--nucleon interactions, 16: 24715
KLABUHN, J., Inelastic pion-nucleon interactions, 16: 24716
KLABUHN, J., Inelastic π^--nucleon interactions, 16: 24717
KLANG, M., Initiation of peroxidation reaction by radiation, 16: 23751
KLAHN, P. G., Analysis of critical experiments, 16: 24409
KLATZO, Igor, Changes in brain caused by α particles, 16: 23492
KLAUDER, J. R., Covariant spin affine connection, 16: 24926
KLEHR, E. H., Solubility of metallic Hg, 16: 23591
KLEIN, A., Theory of fermion systems, 16: 24731
KLEIN, Claude A., Pyrolytic graphite, 16: 24189
KLEIN, D., Effective U-238 resonance capture integrals, 16: 24764 (WAPD-T-1497)
KLEIN, D., Effective U-238 resonance capture integral of U and UO_2, 16: 24395
KLEINFELD, Ruth, Changes in irradiated nerve cells, 16: 23494
KLEINMAN, D. A., Far infrared dielectric dispersion in titanates, 16: 24321
KLIMOV, P. K., Changes of lymphatic system in radiation sickness, 16: 23524
KLIMOVSKAYA, L. D., Antidromic vascular and pupillary reactions under effect of radiation, 16: 23438
KLODT, Donald T., Oxidation resistance of $NbAl_3$, 16: 24174 (TID-16032)
KLOPP, William D., Prog. rpt. on coatings for Ta-base alloys, 16: 24148 (ASD-TR-61-676)
KLOTZ, A. H., Note on spin affine connection, 16: 24924
KLOTZBAUGH, G., Induced conductivity targets in camera tubes, 16: 23853 (WADD-TN-60-307)
KLUGOW, J., Inelas^{ti} · π^--nucleon interactions, 16: 24715
KLUGOW, J., Inelastic π^--nucleon interactions, 16: 24718
KNIBBS, R. H., Thermal conductivity of artificial graphites, 16: 24143 (AERE-R-3973)
KNOLL, K. C., Hanford studies in geochemistry, 16: 25052 (TID-7628 (p.214-36))
KNUDSEN, Harold K., Photomultiplier single-electron statistics, 16: 23893
KO, R., Alkaline earth determinations, 16: 23601 (HW-69677)
KOCH, Lydie, Detection radiation by semiconductors, 16: 23944
KOCH, M., Structures of nitrided zones, 16: 24182 (AEC-tr-5203)
KOCH, R. C., Fission gas release from pebble bed reactor fuel elements, 16: 24627
KOEHLER, W. C., Magnetic structures of Tm, 16: 24202
KOENIG, H., Meteorites with high noble gas content. II., 16: 23999
KOENIG, H., Primordial rare gases in meteorite Breitscheid, 16: 23998
KOENIG, Harold, Effects of nucleic acid antimetabolites on central nervous system, 16: 23478
KOENIGES, Katherine V., Bibliography on MoS_2 as lubricant, 16: 24167 (NP-11899)
KOERNER, J. A., Two-dimensional perturbation code and application to EBR, 16: 24441
KOEROES, E., Solvent effect in exchange reaction, 16: 23573
KOHN, Henry I., Renal changes in irradiated mouse, 16: 23453
KOHN, M. L., Prog. rpt. on nuclear fuel research, 16: 24168 (NYO-2694)
KOHN, R. E., Analysis of Si in cast Fe, 16: 24573
KOHN, Robert E., Determination of Si in Al alloy, 16: 24574
KOJIMA, Kohei, Effects of γ radiation on polyethylene, 16: 24259
KOLAR, O. C., CONEC—coupled neutronics theory code, 16: 24438
KOLBASOVA, V. A., Technology of molding Zr objects, 16: 24138
KOLDITZ, L., Radiolysis of liquid ammonia, 16: 23767

KOLESOV, G. M., Reduction of Pm, 16: 23578
KOMAR, A. A., Hypercharge and degeneracy in respect to isotopic spin, 16: 24681 (JINR-D-976)
KOMAR, A. P., Photodisintegration of N, 16: 24834
KOMAR, A. P., Photonuclear reactions with deuteron emission, 16: 24835
KOMAR, E. G., Design of 7-Bev proton synchrotron, 16: 24872
KOMOCHKOV, M. M., Attenuation of neutrons in concrete, 16: 24908
KONYUKHOV, V. K., EPR and optical spectra for Yb^{3+} ions, 16: 24334
KONZAK, C. F., Efficiency of mutation induction, 16: 23469 (NAS-NRC-891)
KONZAK, C. F., Radiation-induced recombination in octoploids, 16: 23454
KOPALD, H. H., Myocardial blood flow determined with Kr-85, 16: 23362
KOPETSKII, V., Radioisotopic control of wear on bearings, 16: 24037 (AEC-tr-5189)
KORCHEMNAYA, E. K., Separation of small quantities of Ce, 16: 23658
KORENBLIT, I. Ya., Galvanomagnetic phenomena with electron scattering, 16: 24331
KORNEICHUK, G. P., Kinetics of $SO_2 + 0.5\ O_2 \rightleftharpoons SO_3$, 16: 23584
KORTUS, Joseph, Radioisotope labs. in Czechoslovakia, 16: 23809
KOSHKAREV, D. G., Design of 7-Bev proton synchrotron, 16: 24872
KOSICKI, George W., Isotope rate effects in enolization, 16: 23532
KOSOLAPOVA, N. A., Radiosulfur isotope S-35, 16: 24076
KOSTIKOVA, G. I., Study of C isotope exchange reactions, 16: 23558
KOSTIN, M. D., Generalized variational method, 16: 24372
KOSTOMAROV, D. P., Electromagnetic waves theory in plasma, 16: 24899
KOSZALKA, T. R., Creatine synthesis after x irradiation, 16: 23463
KOTOV, B. A., Plasmon spectra in In and InSb, 16: 24329
KOTOV, V. I., Electron acceleration in annular synchrocyclotron, 16: 24866 (JINR-P-914)
KOTULOWA, W., Sterilization of drugs by γ rays, 16: 23424
KOVACH, P., Prog. rpt. on joining refractory metals, 16: 24135 (WAL-460.54/1-1)
KOVAL, Larysa, Reaction of uranyl ion with amino acids, 16: 23387 (UR-611)
KOVALEV, E. E., Dose of cylindrical source in presence of shield, 16: 24909
KOZLOV, F. V., Errors in γ assaying, 16: 23992
KOZLOWSKI, Mieszyslaw, Diamagnetism of the Van Allen zones, 16: 24663
KOZYREVA-ALEKSANDROVA, L. S., Radioisotope I-131, 16: 24075
KRAMER, W. C., Vacuum brazing of superheater fuel plates, 16: 24635
KRASHER, J., Interaction in ion-exchange resin, 16: 23590
KRASOV, V. G., Extraction of U and rare earths, 16: 23793
KRAUS, Kurt A., Packed-column techniques, 16: 23580
KRAUSZ, A., Radiation damage in iron and steel industry, 16: 24031
KRECKER, U., Inelastic π^--nucleon interactions, 16: 24715
KRECKER, U., Inelastic pion-nucleon interactions, 16: 24716
KRECKER, U., Inelastic π^--nucleon interactions, 16: 24717
KRECKER, U., Inelastic π^--nucleon interactions, 16: 24718
KREJCIK, M., Properties of cord under radiation, 16: 24262
KRESS, T. S., In-pile gas-cooled nuclad fuel element test facility, 16: 24643
KRESS, T. S., In-pile gas-cooled fuel test facility, 16: 24950 (ORNL-TM-250)
KRESTNIKOV, Ju. S., Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)
KREVANS, J. R., Platelets transfused into thrombocytopenic recipients, 16: 23526
KREY, Philip W., Nuclear debris in precipitation, 16: 23985 (NYO-9532)
KRIEGER, Theodore J., Gamma dose from solar flare protons incident on Al, 16: 24591
KRISHNA, P. Murali, Prog. rpt. on large fission product β sources, 16: 24698 (RAI-201)
KROHMER, Jack Stewart, Electromagnetic radiations in phantom, 16: 23448
KROTOSZYNSKI, B. K., Radiation-induced alkylation of aromatics, 16: 24588
KROWCYNSKI, L., Sterilization of drugs by γ rays, 16: 23424
KRUGER, Lawrence, Lesions in cerebral cortex by deuteron irradiation, 16: 23490
KRUGERS, J., Suitable isotope and source strength for mass difference problem, 16: 23860 (CEA-tr-A-1122)
KRUISKAMP, M., Scattering of pions on C and O, 16: 24720
KRUPKA, R. M., Arc jet for producing temperature simulation in wind tunnel, 16: 24885 (ASD-TR-61-283)
KRUPP, P., Action of γ radiation on brain, 16: 23505
KRZHEMENEK, Ya., Photodisintegration of N, 16: 24834
KUBOTA, H., Storage of high-level packaged solid wastes, 16: 25068 (TID-7628(p.477-90))
KUECUEK, Mueeyyet, High-frequency ion source efficiency, 16: 23933
KULCHITSKII, L. A., Photonuclear reactions with deuteron emission, 16: 24835
KULIKOV, A. V., Photonuclear reactions with deuteron emission, 16: 24835
KUMPF, G., Nuclear reaction $Th^{232}(Ne^{22},4n)Fm^{250}$, 16: 24781 (JINR-P-896)
KUNCIR, G. F., Accurate computation of Doppler broadening, 16: 24393
KUNDT, U., Inelastic π^--nucleon interactions, 16: 24715
KUNDT, U., Inelastic pion-nucleon interactions, 16: 24716
KUNDT, U., Inelastic π^--nucleon interactions, 16: 24717
KUNZ, F. W., Beta quenched Zr–Nb alloy, 16: 14137
KUNZE, J. F., Nuclear and mechanical effects in SL-1 incident, 16: 24514
KUPTSOV, A. V., Anomalies in μ^- meson decay in mesoatoms, 16: 24278 (JINR-P-971)
KUREPA, M., What isotopes offer us, 16: 24074
KURYSHEV, V. S., Design of 7-Bev proton synchrotron, 16: 24872
KUSHNERIUK, S. A., Neutron absorption in composite cylinder, 16: 24760 (CRT-1079)
KUSHNIRENKO, E. A., Interaction of π^- mesons with He, 16: 24682 (JINR-P-868)
KUZIN, A. M., Initial mechanisms of biological effects of radiation, 16: 23423 (AEC-tr-5215)
KUZNETSOV, A. B., Protons accelerated in 10-Bev synchrophasotron, 16: 24871 (UCRL-Trans-843)
KUZNETSOV, E. V., Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)
KVASOV, V. A., Production of pure fast-neutron fluxes, 16: 24705
KVERNES, Ingard, Constitution of U–Si–Al alloys, 16: 24217

L

LA CHANCE, Lee E., Postirradiative effects of N on hatchability of eggs, 16: 23452
LADA, Witold, Thermal and fast neutron flux in EWA, 16: 25027
LADD, J. A., Data plotting system for use with punched paper tape, 16: 23843 (CREL-1009)
LAIDLER, J. J., Environmental testing of reactor materials, 16: 24239 (HW-SA-2547)
LAIN, Philip J., Fuel assembly handling, EGCR, 16: 24989 (TID-6702)
LAKNER, E., Manufacture of dyeable polytetrafluoroethylene with radiochemical copolymerization, 16: 24207
LALL, Prithvi Chand, Gamma-gamma correlation in Ti-46, 16: 24815
LAMERTON, Bruce A., Concrete for shielding atomic energy plants, 16: 24225
LANDERMAN, E., Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)
LANE, R. K., Resonance absorption in materials with grain structure, 16: 24394
LANG, S. M., High-temperature x-ray diffraction technology, 16: 23837 (ARL-62-315)
LANGDON, W. R., Bibliocabstract on radiation effects, 16: 24233 (57GL77)
LANGE, W. H., Radioisotopic study of gyro bearing lubrication, 16: 24582
LANGHAM, W. H., Estimation of fast neutron doses in man, 16: 23379 (TID-7616(p.89-97))
LANGHAM, Wright H., Radiation problems of space conquest, 16: 23432
LANGKAU, R., Particle discrimination with KI(Tl) scintillators, 16: 23956
LANIUS, K., Inelastic π^--nucleon interactions, 16: 24715
LANIUS, K., Inelastic pion-nucleon interactions, 16: 24716
LANIUS, K., Inelastic π^--nucleon interactions, 16: 24717
LANIUS, K., Inelastic π^--nucleon interactions, 16: 24718
LANNING, W. D., Spherical harmonics technique in γ transport, 16: 24602
LANTER, Robert J., Nearly-4π liquid scintillation counter, 16: 23921
LANTZ, P. M., Neutron capture cross section and resonance capture of Ce-144, 16: 24389
LAPIDUS, Gabriel, Kinetics of D exchange reactions, 16: 23685
LAPIDUS, L. I., Exchange pion-nucleon scattering, 16: 24690 (JINR-P-960)

LAPIDUS, L. I., Scattering of γ quanta and polarization of nuclei and nucleons, 16: 24782 (JINR-P-967)
LA PLANTE, J. P., Chlorination of U and fission product oxides, 16: 23663 (ANL-6546)
LARKIN, A. I., Superconductivity in semiconductors, 16: 24332
LARRAS, J., Marine bed-load and displacement studies, 16: 24001
LARSON, E. T., Meaning of characteristic curves, 16: 23968 (ANL-6515(p.87-101))
LARSSON, Borje, Local irradiation of central nervous system with high-energy protons, 16: 23489
LA SALLE, R. A., Thin diffused-junction counters, 16: 23898
LASKORIN, B. N., Extraction of U and rare earths, 16: 23793
LATHROP, K. D., Neutron thermalization by bound moderators, 16: 24376
LATIMER, Robert M., Spallation-fission competition in At, 16: 24854
LAURENCE, G. S., Study of halogen atom reactions, 16: 23588
LAVRUKHINA, A. K., Reduction of Pu, 16: 23578
LAWRENCE, A. F., Proton spectrometer, 16: 23832 (AD-269867)
LAWROSKI, H., Sensitivity of pressure transducers, 16: 24554
LAYNO, Salvador B., Techniques for Monte Carlo calculations, 16: 24605
LAZAR, M., Cross-linking of polyethylenes, 16: 23542
LAZIEV, E. M., Electron beam grouping, 16: 24875
LEACH, J. S. Ll., Liquid metal solution calorimeter, 16: 23949
LEACHMAN, R. B., Developments in fission physics, 16: 24346
LEAF, A. C., Alkaline earth determinations, 16: 23601 (HW-69677)
LEARY, J. A., Plutonium electrorefining, 16: 24109 (LA-2666)
LEARY, Robert W., Effects of radiation on behavior and blood, 16: 23511
LEAVITT, C. P., Gamma-ray satellite experiment, 16: 23929
LEDDICOTTE, G. W., Determination of As in Cu alloys and organic materials, 16: 24565
LEDDICOTTE, G. W., Determination of minor elements in Be, 16: 23634 (TID-7629(p.245-57))
LEDDICOTTE, G. W., Determining particle size distributions of ThO_2, 16: 23775 (ORNL-TM-255)
LEDDICOTTE, G. W., Trace element determination in Nb and Zr, 16: 23633 (TID-7629(p.239-44))
LE DOUX, J. C., Atomic defense engineering education, 16: 24653
LEE, Juliet, Mott scattering of polarized muons, 16: 24747
LEE, W. W., Direct-reading Be air monitor, 16: 23615 (TID-7629(p.16-21))
LEFEVRE, Harlan Wayne, Neutrons from deuteron breakup on D, T, and He-4, 16: 24821
LEFORT, Marc, Separation of Pu and U by solvent extraction, 16: 23794
LEGGETT, H., Prog. rpt. on refractory materials, 16: 24178 (WAL-TR-766-3/1-3)
LE GRAND, Harry E., Management of radioactive wastes, 16: 25041 (TID-7628(p.67-76))
LEIPZIGER, Fredric D., Solid-sample mass spectrometry, 16: 23625 (TID-7629(p.142-50))
LEITZ, F. B., Core design for 500-Mwe fast oxide reactor, 16: 24479
LEKSELL, Lars, Local irradiation of central nervous system with high-energy protons, 16: 23489
LELLOUCHE, Gerald S., Control of spatial Xe oscillations, 16: 24525
LEMBRA, J., Focusing properties of cyclotron, 16: 24876
LEMM, G., Detection of cable defects by radioisotopes, 16: 24062
LEMPERT, J., Induced conductivity targets in camera tubes, 16: 23853 (WADD-TN-60-307)
LENY, J. C., ESSOR: specific test reactor for ORGEL program, 16: 24451
LENY, J. C., ORGEL: European power reactor design, 16: 24450
LEON, Melvin, Negative meson absorption in liquid H, 16: 24822
LEONARD, J. H., Nuclear behavior of Shippingport Reactor, 16: 24492
LESAGE, J., Wet steam cooling experiments, 16: 23816 (EURAEC-42)
LESHER, Samuel, Renal changes in irradiated mouse, 16: 23453
LEUTWYLER, H., Covariant spin affine connection, 16: 24926
LEUZE, R. E., Chemical processing for transuranium production, 16: 24342
LEVEDAHL, William J., Application of steam energy flow to reactor design, 16: 24508
LEVEQUE, P., Radio-activation analysis in industry, 16: 23643 (AEC-tr-5116)
LEVIN, B. A., Production of pure fast-neutron fluxes, 16: 24705
LEVINE, Melvin M., High-energy resonance integral, 16: 24396
LEVINSON, Billey, Effects of neonatal irradiation on learning, 16: 23508
LEVINSON, Leonard S., High-temperature drop calorimeter, 16: 23951
LEVITT, L. C., Two-dimensional hydromagnetic steady flows, 16: 24887
(D1-82-0170)
LEVY, H. A., Fortran program for single crystal absorption corrections, 16: 24095 (ORNL-TM-229)
LEVY, M., High-energy scattering, 16: 24740
LEVY-LEBLOND, J. M., Diffusion with charge exchange, 16: 24727
LEW, D. E., Radiation of SAP-clad UO_2 fuel, 16: 24458
LEW, M., Determination of burnup in Pu reactor fuels, 16: 23628 (TID-7629(p.177-83))
LEWIS, W. B., Growth of nuclear power, 16: 24978 (DL-49)
LEY, F. J., Radiation process for inhibition of sprouting in potatoes, 16: 23411 (AERE-R-3977)
LICCIARDO, R., Concentric tubular reactor fuel elements, 16: 24929 (AAEC/E-89)
LIE, Randi, Antimony-124 chloride in rat following inhalation, 16: 23386 (UR-608)
LIEBERMAN, B., Symbols for instrument flowsheets and drawings, 16: 23353 (CF-57-2-1(Rev.1))
LIEDEL, A. L., MINK (MUFT-KATE into KARE), 16: 24093 (KAPL-M-RPC-4)
LIENARD, G., Elementary carbon exchange, 16: 23576
LIESER, K. H., Principles of ion exchange, 16: 23575
LIESER, K. H., Radiochemical determination of small solubilities, 16: 23706
LIIMATAINEN, R., Sensitivity of pressure transducers, 16: 24554
LIIMATAINEN, Robert C., Behavior in water of UO_2 core, stainless steel-304 clad fuel pins, 16: 24617
LIN, Ch'en-ch'eng, Radiochemical determination of K, 16: 23647
LIN, Dso-Liang, Charge dependent effects on nuclear forces, 16: 24301
LINDENBERGER, K. H., Photoneutrons from $C^{12}(\gamma,n)C^{11}$ and $O^{16}(\gamma,n)O^{15}$, 16: 24864
LINDNER, Clyde Nimmer, Electron production of single pions and photons, 16: 24709
LINDNER, R., Diffusion of Xe-133, Rn-222 and I-131 in ThO_2, 16: 23674 (AEC-tr-5178)
LINDNER, R., Fission product diffusion in nuclear fuels, 16: 24183 (AEC-tr-5206)
LINDSTROEM, Olle, Fuel composition for homogeneous reactors, 16: 24953 (AEC-tr-5165)
LINGAFELTER, J. W., Irradiation tests of thin-wall stainless steel clad, UO_2 fuel rods, 16: 24618
LINN, T. A., Observations of SL-1 incident effects, 16: 24513
LIPAS, Pertti Olavi, Octupole vibrations of even-even nuclei, 16: 24302
LIPETZ, Leo E., Effects of radiation on vision, 16: 23500
LIPPINCOTT, S. W., Human tolerance to thermal neutrons, 16: 23495
LITTON, F. B., Melting and casting of UC, 16: 24134 (TID-15337)
LITTON, F. B., Prog. rpt. on nuclear fuel research, 16: 24168 (NYO-2694)
LIU, D. C., Scintillation response of alkali iodides, 16: 23883
LIU, Yuan-lung, Fenghuangite, 16: 23997
LLORY, J., Action of x-rays on plasma proteins, 16: 23412 (CEA-2132)
LLOYD, M. H., Americium–Cm recovery from Pu process waste, 16: 24343
LLOYD, R. C., Critical mass experiments with $Pu(NO_3)_4$, 16: 24416
LLOYD, R. C., Experience in Hanford Pu critical mass facility, 16: 24417
LLOYD, W. A., Fission-fragment irradiation of methane, 16: 24589
LOEB, Ernest, Water moderated nuclear research reactor, 16: 25028
LOEB, Jean, Application of radioisotopes, 16: 24069
LOENSJOE, O., Proton bombardment of Al, 16: 24848
LOEWENSTEIN, W. B., Influence of core shape on fast reactor criticality, 16: 24397
LOGUNOV, A. A., Surface of special points of Feynman's diagram, 16: 24683 (JINR-P-889)
LOMENICK, T. F., Land burial of solid waste, 16: 25064 (TID-7628(p.437-59))
LOMONOS, P. I., Effect of radioisotopes on peripheral blood composition, 16: 23443
LONG, E. L., Jr., Beryllium-sheathed UO_2 fuel element irradiation, 16: 24613
LONG, R. L., Noise measurements on reactor servo-control system, 16: 24551
LONGANO, A. J., Fast neutron cross sections, 16: 24796 (UNC-5002)
LONGEQUEUE, J. P., Alpha spectrometry using junction detectors, 16: 23840 (CEA-2138)
LONGEQUEUE, N., Alpha spectrometry using junction detectors,

16: 23840 (CEA-2138)
LONGONI, A. M., Potential scattering for complex energy, 16: 24310
LORENZ, Alex, Gamma energy deposition in infinite source media, 16: 24287 (UCRL-6891)
LOTTES, P. A., Prog. rpt. on boiling water reactor. I., 16: 24931 (ANL-6561)
LOVE, Gordon R., Fission product diffusion in nuclear fuels, 16: 24183 (AEC-tr-5206)
LOWE, J., First excited states of C-15 and B-10, 16: 24855
LOWER, George W., Ion exchange recovery of U, 16: 23778 (ACCO-44)
LUDWIG, G. H., Scintillation counter telescope, 16: 23925
LUND, J. W., Hybrid gas lubricated journal bearing, 16: 23806 (TID-15295)
LUNDGREN, G., Resonance absorption of U metal and oxide, 16: 24759 (AE-77)
LUNDIN, Charles E., Oxidation resistance of $NbAl_3$, 16: 24174 (TID-16032)
LUNDQUIST, N., Electronic structure of MnB, 16: 23662 (AE-76)
LUR'E, B. G., Densities of KCl–RbCl crystals, 16: 23692
LURIE, H., Neutron thermalization by bound moderators, 16: 24376
LURIO, A., Zeeman corrections for an (sl) configuration, 16: 24324
LURIO, Allen, Hyperfine structure of the ^2P states of Zn-67 and Mg-25, 16: 24849
LVOV, S. N., Heat conduction of refractory borides, carbides, and nitrides, 16: 24208
LYMAN, John, Changes in brain caused by α particles, 16: 23492
LYNCH, Gerald R., Pion-pion interaction, 16: 24750
LYON, W. S., Manganese bath measurements of η of Pu-239, 16: 24431
LYONS, M. F., Annular fuel element heat transfer, 16: 24502
LYONS, M. F., Central melting in UO_2 fuel, 16: 24624

M

MACCHI, I. Alden, Prog. rpt. on effects of radiation on adrenocortical tissue, 16: 23417 (TID-16122)
MAC DONALD, J. E., Program for computation of total macroscopic cross section and collision probabilities, 16: 24089 (GEMP-114)
MAC DONALD, J. E., Program for preparation of spectrum tables, 16: 24090 (GEMP-116)
MAC DONALD, J. E., Program for computing nuclear excitation and transition probabilities, 16: 24091 (GEMP-117)
MAC DONALD, J. E., Program for approximating cross section dependence on energy, 16: 24678 (GEMP-113)
MAC DONALD, J. E., Program for averaging differential scattering cross sections, 16: 24679 (GEMP-115)
MAC DONALD, R. D., Examination of irradiated SAP clad UO_2 fuel element, 16: 24235 (CRFD-1084)
MACFARLANE, C. H., Radiation hazards at Chalk River, 16: 24009 (CRRIS-1071)
MAC KAY, A. J., Response of NaI(Tl) to radiation, 16: 23879
MACKEWICZ, W. V., Local film coefficients on ML-1 fuel elements, 16: 24504
MACKIN, Robert J., Jr., Status of DCX-2 program, 16: 24445
MACKLIN, R. L., Manganese bath measurements of η of Pu-239, 16: 24431
MAC PHERSON, R. E., Bearing materials for EGCR, 16: 24170 (ORNL-TM-249)
MADELL, J. T., Flux distribution in cavity assembly, 16: 24428
MADEY, Richard, Gamma dose from solar flare protons incident on Al, 16: 24591
MAGAT, Michel, Ionic polymerization with radiations, 16: 23749
MAGLIC, Bogdan C., Pion-pion interaction, 16: 24750
MAGNUSON, Dale W., Prompt neutron decay constants for HFIR, 16: 24423
MAIER-HUSER, H., Preparing sulfurated substances, 16: 23561
MAIN, G. W., Influence of core shape on fast reactor criticality, 16: 24397
MAIR, William, Local irradiation of central nervous system with high-energy protons, 16: 23489
MAK, A. A., Spark discharge in atmospheres of Ar and Xe, 16: 24289 (NP-tr-898)
MAKAROV, L. L., Densities of KCl–RbCl crystals, 16: 23692
MAKHNOVSKII, E. D., Photonuclear reactions with deuteron emission, 16: 24835
MALINSKII, Yu. M., Diffusion processes in several polymers. III., 16: 24268
MALINSKII, Yu. M., Increasing stability of polyolefin fibers by radiation, 16: 24255
MALIS, Leonard I., Lesions in cerebral cortex by deuteron irradiation, 16: 23490
MALKIN, V. L., Measurement of diffusion coefficients for silicate with tracers, 16: 24038 (AEC-tr-5191)
MALTSEV, V. M., Production of deuterons, 16: 24843
MALVICINI, A., Fall-out in milk in Milan, 16: 24023
MALYSHEV, I. F., Design of 7-Bev proton synchrotron, 16: 24872
MALYSHEV, V. N., Densities of KCl–RbCl crystals, 16: 23692
MALYUTINA, T. M., Determination of Nb, 16: 23659
MANABE, Tonosobu, Primary radicals in vinyl polymerization, 16: 23738
MANAGAN, W. W., Alkali halide scintillation crystals, 16: 23877
MANDEL, M., Zeeman corrections for an (sl) configuration, 16: 24324
MANDELSTAM, Stanley, Quantum electrodynamics without potentials, 16: 24918
MANDELSTAM, Stanley, Quantization of gravitational field, 16: 24919
MANDUCHI, C., Capture ratio in Cr-51 decay, 16: 24844
MANGUM, B. W., Relaxation in rare earth double nitrates, 16: 24313
MANN, N. M., Boron-10 diffused junctions in n-type Si, 16: 23903 (UAC-6130)
MANNESCHMIDT, J. F., Ground disposal of liquid wastes, 16: 25070 (TID-7628(p.506-12))
MANTEIFEL, V. M., Enterochromaffin cells of duodenum in acute radiation sickness, 16: 23519
MARAMAN, W. J., Plutonium electrorefining, 16: 24109 (LA-2666)
MARCHAL, M., Prog. rpt. on C–U–Th system, 16: 24179 (AEC-tr-5174)
MARCUS, Yizhak, Activities of radioisotopes, 16: 23712 (NP-11744)
MARGULIS, U. Ya., Protection against x and γ rays, 16: 24034
MARGULIS, U. Ya., Utilization factor of γ irradiation facilities, 16: 24046
MARINSKY, J. A., Interaction in ion-exchange resin, 16: 23590
MARINSKY, Jacob A., Prog. rpt. on nuclear chemistry, 16: 23529 (TID-16024)
MARMER, E. N., Heat conduction coefficient of graphite, 16: 24209
MARR, Robert B., Kinematic structure of vertex functions, 16: 24860
MARSHALL, G. D., Propane vibrational analysis, 16: 23668 (IDO-16769)
MARSHALL, R. A., Large homopolar generator, 16: 24877
MARTELLY, Julien, Investigation of neutron propagating media, 16: 23814
MARTENEY, Pierre J., Effects of $N^{14}(n,p)C^{14}$ in NH_4Cl, 16: 23734
MARTENS, John H., Transactions of American Nuclear Soc., June 18-21, 1962, 16: 24338
MARTIN, S. B., Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
MARTON, J., Preparing C-14-labeled isocyanates, 16: 23557
MARTON, Joseph, Preparation of C-14 tetrazolium salts, 16: 23555
MASLAN, Frank, Enthalpy—entropy diagram of Xe, 16: 23701
MASLOVA, A. F., Activity of catecholamines after irradiation, 16: 23439
MASON, E. A., Heat transfer of irradiated Santowax OMP, 16: 24456
MASON, E. A., In-pile irradiation of Santowax OMP, 16: 24455
MASON, E. A., Prog. rpt. on organic moderator-coolant irradiation loop, 16: 24941 (IDO-11101)
MASON, Edward A., Organic-cooled reactors—a review, 16: 24449
MASON, Edward A., Solvent extraction of nitrosylruthenium, 16: 23791 (TID-16139)
MASON, I. B., Thermal conductivity of artificial graphites, 16: 24143 (AERE-R-3973)
MASSAROTTI, A., Preventing resonance discharge in cavity resonator, 16: 24869 (AERE-Trans-890)
MATHER, George C., Lymphopenia produced by irradiation, 16: 23434 (BNL-6011)
MATHESON, R. M., Photomultipliers for scintillation counting, 16: 23887
MATLACK, G. M., Determination of burnup in Pu reactor fuels, 16: 23628 (TID-7629(p.177-83))
MATLACK, G. M., Determination of specific activity of Pu, 16: 23629 (TID-7629(p.185-92))
MATLACK, G. M., High-speed computers in Pu analyses, 16: 23630 (TID-7629(p.193-208))
MATOUSEK, J. F., Modification of EBWR for higher-power operation, 16: 24964 (ANL-6552)
MATSUMOTO, W. Y., Alkaline earth determinations, 16: 23601 (HW-69677)
MATZKE, H., Fission product diffusion in nuclear fuels, 16: 24183 (AEC-tr-5206)

HATZKE, Hj., Diffusion of Xe-133, Rn-222 and I-131 in ThO_2, 16: 23674 (AEC-tr-5178)
HAU, Robert, Vish, Effect of Coulomb field on bremsstrahlung, 16: 24802
HAUTE, R. L., Liquid scintillation counting of H-3, 16: 24578
HAUTI, A., Pulse scalers and preselectors, 16: 23845 (NP-11734)
HAUTNER, Henry G., Prog. rpt. on anti-radiation agents, 16: 23515 (AD-269963)
HAWSON, C. A., Disposal facilities, AECL, 16: 25038 (TID-7628(p.3-9))
HAXWELL, R. L., Effect of seismic vibrations on EGCR, 16: 24986 (ORNL-3224)
HAYAUD, Pierre-Noel, Terrestrial magnetic field for study of cosmic rays, 16: 24664
HAYER, James W., Nuclear particle detectors, 16: 23894
HAYER, W. J., Radioisotopic study of gyro bearing lubrication, 16: 24582
HAYKUTH, D. J., Prog. rpt. on coatings for Ta-base alloys, 16: 24148 (ASD-TR-61-676)
HAZDIYASNI, K. S., Refractory metal alkoxides, 16: 24147 (ASD-TDR-62-90)
HC AFEE, John G., Measurement of Hg-203 chlormerodrin accumulation by kidneys, 16: 23400
HC CHESNEY, M., Rotating mirror smear camera for arc discharge studies, 16: 23936
HC CLELLAND, C. L., First excited states of C-15 and B-10, 16: 24855
HC CLUNG, R. W., Low-voltage radiography, 16: 23980
HC CONNELL, James V., Elevation of LD_{50} level in *Planaria*, 16: 23414 (TID-15984)
HC COOL, W. J., Critical experiments on PWR core mockups, 16: 24413
HC COOL, Whittie J., Startup portable nuclear power station, 16: 24494
HC CUE, James C., Utilization of radioisotope-excited x rays in fuel analysis, 16: 23622 (TID-7629(p.81-90))
HC DONALD, F. B., Scintillation counter telescope, 16: 23925
HC DONALD, R. E., Gamma spectrometer for nondestructive inspection, 16: 24555
HC DOWELL, Arnold A., Effects of radiation on psychologic processes, 16: 23514
HC DOWELL, Arnold A., Performance of monkeys after irradiation to head, 16: 23512
HC DOWELL, Robin S., Pure rotational spectrum of NT_3, 16: 23698
HC FARLING, J. L., Calibration of isotopic neutron source, 16: 24570
HC GARRY, E. D., Uranium-235 fission-product poison experiments, 16: 24382
HC GAUGH, J. D., Reactivity calculations in Yankee Core I, 16: 24471
HC GAUGH, J. D., Yankee fuel cycle development, 16: 24468
HC GEHEE, R. M., Evaluation of scintillation systems, 16: 23848 (DCTM-326-61(14))
HC HENRY, R. E., Recovery of irradiated U by extraction procedure, 16: 24647
HC HENRY, R. E., Solvent extraction of Nd and Pm, 16: 23788 (ORNL-TM-184)
HC LAUCHLAN, K. A., Gamma-radiolysis of gases, 16: 23730
HC MASTER, A. D., Beta quenched Zr–Nb alloy, 16: 24137
HC MURRAY, C. S., Spectrograph for detection of Be, 16: 23614 (TID-7629(p.1-15))
HC NAMARA, V. M., Refining of U, 16: 23774 (NP-11877)
HC QUILKIN, F. R., Beryllium-sheathed UO_2 fuel element irradiation, 16: 24613
HC VEY, John W., Plant disassembly procedure for D102A, 16: 24977 (DC-61-6-16)
HC VEENY, D. J., Radio-chromatogram scanner, 16: 23940
HC WILLIAMS, P., High-speed computers in Pu analyses, 16: 23630 (TID-7629(p.193-208))
HEADOWS, J. W. T., Determination of burnup in Pu reactor fuels, 16: 23628 (TID-7629(p.177-83))
HEAKIN, J., Determination of U in waste products, 16: 23637 (TID-7629 (p.285-94))
HEDVEDEV, S. S., Radiolysis of polymers, 16: 23745
HEE, Jack E., Titrimetric method for Ga, 16: 23645
HEEN, J. L., Fuel element surface temperature, 16: 24505
HEGERTH, F. H., Economic evaluation of control rods, 16: 24485
HEHALL, F. E., Foreign gas cooled reactors, 16: 24975 (DC-60-10-154)
HEIER, H. W., Inelastic π^--nucleon interactions, 16: 24715
HEIER, H. W., Inelastic pion-nucleon interactions, 16: 24716
MEIER, H. W., Inelastic π^--nucleon interactions, 16: 24717
MEISEL, J., Preparing C-14-labeled isocyanates, 16: 23557
MEISEL, Julie, Preparation of C-14 tetrazolium salts, 16: 23555
MEISEL, M. N., Sterilization of food products by irradiation, 16: 24042
MEISSNER, William A., Harmful somatic effects of radiation, 16: 24560
MELEHAN, J. B., In-pile fission gas release from UO_2, 16: 24614
MELESE, Gilbert B., Heat conduction in one-dimensional geometry, 16: 24500
MELIN, O., Mass number assignments and γ spectra of Sn and Sb isotopes, 16: 24805
MELISSINOS, A. C., Monte-Carlo calculation of a nuclear cascade, 16: 24697 (NYO-10132)
MELNECHUK, Theodore, Tools for analytical chemistry, 16: 23648
MEL'NIKOV, V. N., Isotope effects in β decay of Pb isotopes, 16: 23722 (AEC-tr-5150)
MENDEZ, J., Solvent extraction studies of halides, 16: 23582
MENGE, E. E., Prog. rpt. on nuclear properties of Re, 16: 24789 (NP-11874)
MENGELKAMP, R. A., Out-of-pile electron irradiation circulating loop, 16: 24460
MERIWETHER, H. T., Stability of vitamin B_{12}–Co^{60} content of liver, 16: 23397 (BNL-4888)
MERKUL'EV, Yu. A., Diffusion and thermalization of neutrons in water and ice, 16: 24765 (AEC-tr-5143)
MERRETT, W. F., Monitoring of nepheline syenite glass disposals, 16: 25039 (TID-7628(p.9-12))
MERRILL, L. J., Studies of irradiated polypropylene, 16: 24253
MERRILL, M. H., Reactor shutdown mechanisms in Peach Bottom HTGR, 16: 24519
MESHKOVSKII, A. G., Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)
MESTRE, E., Treatment of solid radioactive waste, 16: 25034 (CEA-2147)
METZGER, A. E., Lunar composition by scintillation spectroscopy, 16: 23930
MEYER, A., Effect of delta rays on inorganic scintillators, 16: 23880
MEYER, E. F. H., Crystallographic D-space computer program, 16: 23527 (ANL-6519)
MEYER, S. L., Particle production by protons, 16: 24858
MEYER-BERKHOUT, U., Photoneutrons from $C^{13}(\gamma,n)C^{12}$ and $O^{18}(\gamma,n)O^{17}$, 16: 24864
MEYERHOFF, R. W., Anisotropic thermal expansion of single crystals, 16: 24193 (IS-292)
MEZHIROVA, L. P., Carbanionic mechanism of polymerization under γ rays, 16: 23758
MICELI, R., Telecesium therapy, 16: 23399
MICHAEL, H., Chemical decontamination for nuclear reactors, 16: 24496
MICHAELSON, S. M., Late manifestations of body radiation, 16: 23419 (UR-609)
MICHELSON, C., In-pile loop for EGCR, 16: 24987 (ORNL-TM-108)
MIESOWICZ, Marian, Interactions of nucleons with heavy nuclei, 16: 24662 (PAN-291/VI)
MIGICOVSKY, B. B., Radioactive sulfate uptake in chick stomach, 16: 23401
MIHALCZO, J. T., Critical behavior of unreflected, unmoderated U–Mo alloy assembly, 16: 24540
MIHALCZO, J. T., Reactivity calibrations and fission-rate distribution, 16: 24949 (ORNL-TM-189)
MIHALCZO, J. T., Super-prompt-critical behavior of U–Mo assembly, 16: 24674 (ORNL-TM-230)
MILBURN, Richard H., Scintillation bubble chamber, 16: 23878
MILLER, C. E., Jr., In-pile melting of UO_2 fuel, 16: 24615
MILLER, Dorothea Starbuck, Radiation and audiogenic seizures, 16: 23499
MILLER, G. E., Analysis of radiation heating experiment, 16: 24240 (NARF-61-40T)
MILLER, G. L., Silicon surface barrier particle detectors, 16: 23838 (BNL-737)
MILLER, J., Temperature coefficients in ZrH moderated reactors. I., 16: 24380
MILLER, J., Temperature coefficients in ZrH moderated reactors. II., 16: 24381
MILLER, J. A., Analysis of Np-237 in human urine, 16: 23375 (TID-7616 (p.51-9))

MILLER, J. W., Program for computing Fermi level in non-metals, 16: 24158 (K-1526)
MILLER, L. L., Creatine synthesis after x irradiation, 16: 23463
MILLER, N. E., Measurement of short-lived fission gases, 16: 24563
MILLER, P. D., Corrosion analysis of VPP components, 16: 24118 (BMI-X-201)
MILLER, Robert C., Far infrared dielectric dispersion in titanates, 16: 24321
MILLER, S. H., Radiation vulcanization of hydrocarbon polymers, 16: 24254
MILLER, W. J., Yankee plant and reactor performance, 16: 24467
MILNES, M. V., Physical and thermodynamic properties of biphenyl, 16: 24461
MILOJEVIC, A., What isotopes offer us, 16: 24074
MINGLE, J. O., Disadvantage factors for slab geometry, 16: 24402
MINNICK, L. E., Yankee plant and reactor performance, 16: 24467
MINTS, A. L., Design of 7-Bev proton synchrotron, 16: 24872
MINTS, Stefan, Separation of Th from molten salts, 16: 23672 (PAN-287/IV)
MIQUEL, Jaime, Changes in brain caused by α particles, 16: 23492
MIROCZNIK, Ella Y., Prog. rpt. on large fission product β sources, 16: 24698 (RAI-201)
MISHO, Renzi Hanna, Infrared absorption of thin films of LiF and LiH, 16: 23690
MITCHELL, J. A., Use of Gd septa in slab cores, 16: 24422
MITCHELL, V. E., Estimation of fast neutron doses in man, 16: 23379 (TID-7616(p.89-97))
MITSUISHI, Masaru, Improvement of dyeing properties of fibers by γ irradiation, 16: 24265
MIURA, Masatosi, Polymerization of polyethylene by γ rays, 16: 23718 (AEC-tr-4321)
MIYOSHI, Hideo, Survival of bacteria irradiated with γ rays. I., 16: 23457
MLADENOV, I., Transformation of rubbers under γ radiation, 16: 23543
MOCOROA, A., Tellurium-121 isomeric pairs in Sb-121(d,2n) reaction, 16: 24786 (NP-11791)
MOFFAT, J. W., Low energy scattering theory, 16: 24912 (AD-270903)
MOFFAT, J. W., Pion-pion scattering, 16: 24723
MOGILEVSKII, E. P., Effect of C content of steels on diffusion of Cr, 16: 24199
MOGUTNOV, B. M., Measurement of diffusion coefficients for silicate with tracers, 16: 24038 (AEC-tr-5191)
MOKUL'SKII, M. A., Kinetic processes in irradiated substances, 16: 23755
MOLLENAUER, J. F., Silicon surface barrier particle detectors, 16: 23838 (BNL-737)
MOLNAR, Ferenc, Chemical processing of U in Hungary, 16: 23795
MOLNAR, Ferenc, Production of carrier-free radioisotopes. III., 16: 24081
MOLNAR, Ferenc, Production of carrier-free radioisotopes. IV., 16: 24082
MOLNAR, Jozsef, Production of carrier-free radioisotopes. V., 16: 24083
MOLZON, Arnold E., Bibliography on degradation and fracture of plastics, 16: 24112 (PLASTEC-NOTE-2)
MONAHAN, T. I., Thermal radiation measurements, 16: 23855 (WT-544)
MONIN, A. S., Turbulent diffusion in ground layer of atmosphere, 16: 23991 (AWRE-Trans-34)
MONKS, A. L., Heavy water analyzer, 16: 23623 (TID-7629(p.91-109))
MONKS, A. L., Prog. rpt. on C–U–Th system, 16: 24179 (AEC-tr-5174)
MONNARD, P., Electrostatic filter for radioactive aerosols, 16: 24021 (CEA-tr-A-1002)
MONNIER, Marcel, Action of γ radiation on brain, 16: 23505
MONOD, Philippe, Bubble studies, 16: 24274 (CEA-BIB-26)
MONOSZON, N. A., Design of 7-Bev proton synchrotron, 16: 24872
MONROE, R. E., Electron-beam welding of W, 16: 24131 (DMIC-Memo-152)
MOOKHERJI, A., Crystalline electric field on Yb^{3+} ion, 16: 24304
MOON, C. W., Design technology for GCR. I-III., 16: 24967 (APEX-800 (Pt.A))
MOORE, C. F., Ytterbium-169 for industrial radiography, 16: 24584
MOORE, J. G., Extraction of Nb-95 from HNO_3 solutions, 16: 23787 (ORNL-3285)
MOORE, M. S., Spin dependence of fission widths, 16: 24348
MOORE, R. H., Control method and reflector materials, 16: 24487
MOORE, Sophie, Neutron Cross Section Newsletter No. 6, 16: 24776 (BNL-732)
MORANVILLE, C., Fuel and cladding for the ORGEL Project, 16: 24464
MORAVEK, F., Grains of P-32 used for clinical purposes, 16: 23365
MORAVEK, P. H., Selection rules for $N\bar{N}$ annihilation, 16: 24735
MORELLE, J. M., Meltdown studies of irradiated nuclear fuel, 16: 24642
MORGAN, A. N., Plutonium electrorefining, 16: 24109 (LA-2666)
MORGAN, D. T., Heat transfer of irradiated Santowax OMP, 16: 24456
MORGAN, D. T., In-pile irradiation of Santowax OMP, 16: 24455
MORGAN, D. T., Prog. rpt. on organic moderator-coolant irradiation loop, 16: 24941 (IDO-11101)
MORGAN, J. G., Beryllium-sheathed UO_2 fuel element irradiation, 16: 24013
MORGAN, J. M., Jr., Land burial of radioactive wastes, 16: 25062 (TID-7628(p.396-427))
MORGAN, James M., Jr., Conference on ground disposal of radioactive wastes, 16: 25037 (TID-7628)
MORRIS, Robert, Rocket-borne magnetometer, 16: 23836 (AFSWC-TDR-62-25)
MORRISON, D. L., Xenon release from recoil-damaged Al_2O_3, 16: 24619
MORRISON, G. C., Semiconductor fast neutron detectors, 16: 23899
MORTON, John R., III, Application of recoil techniques, 16: 24853
MOSHINSKY, M., Soluble many-body problem for particles, 16: 24755
MOSKALEV, V. I., Interaction of π^- mesons with He, 16: 24682 (JINR-P-868)
MOSKALEV, Yu. I., Effect of rhythm of Sr-90 administration on accumulation and elimination from bones, 16: 23441
MOTSINGER, R. E., Design technology for GCR. I-III., 16: 24967 (APEX-800(Pt.A))
MOULTHROP, H. A., Shielding for Pu reclamation facility, 16: 23780 (HW-68021)
MOUNTFORD, L. A., Calculations of a multispectrum critical assembly, 16: 24406
MOY, D., Ion exchange of lanthanide and actinide systems, 16: 23571
MOZER, F. S., Proton spectrometer, 16: 23832 (AD-269867)
MRAZ, Frank R., Intestinal absorption of Ca-45 and Sr-85, 16: 23398 (HW-SA-2519)
MUELLER, James J., Fission product retention on metallic surface, 16: 23779 (DC-61-6-5)
MUELLER, M. H., Crystallographic D-space computer program, 16: 23527 (ANL-6519)
MUELLER, R. E., Localized source multiplication and reactor startup, 16: 24405
MULAS, P., Formation of NO_3 in liquid air by fast neutrons, 16: 24587
MULLIN, F. E., MUFT revision—fast neutron spectrum code for IBM-650, 16: 24092 (IDO-16735)
MULLINS, L. J., Plutonium electrorefining, 16: 24109 (LA-2666)
MULLINS, W. T., Determination of minor elements in Be, 16: 23634 (TID-7629(p.245-57))
MULLINS, W. T., Trace element determination in Nb and Zr, 16: 23633 (TID-7629(p.239-44))
MUNNO, F. J., Prog. rpt. on nuclear properties of Re, 16: 24789 (NP-11870)
MUNOZ-DELADO ORTIZ, Jose Antonio, Preservation of food: antibiotics, refrigeration, and radiation, 16: 24045
MUNSE, W. H., Fatigue of metals, 16: 24172 (SSC-137)
MURIN, A. N., Synthesis of organic compounds of Po, 16: 23721 (AEC-tr-5149)
MURPHY, Preston Vincent, Iron sulfate dosimetry of γ radiation, 16: 23781
MURRAY, R. B., Effect of delta rays on inorganic scintillators, 16: 23880
MURTHA, B. E., Vibratory compaction of UO_2 fuel elements, 16: 24621
MURTHY, H. Sreedhara, Rotational constants of $a(C \rightarrow X)$ band system of ZnO, 16: 24303
MUSAEV, U. N., Radiation copolymerization of acrylonitrile, 16: 23541
MUSCHTER, Harry, Counting apparatus for radiation, 16: 23957
MYAE, E. A., Electron acceleration in annular synchrocyclotron, 16: 24861 (JINR-P-914)
MYASHIKOV, A. S., Compensation of ion space charge by electrons, 16: 24288 (FTD-TT-62-317)
MYERS, L. S., Jr., Determining tritium water in urine, 16: 23642 (UCLA-504)
MYZNIKOV, K. P., Protons accelerated in 10-Bev synchrophasotron, 16: 24871 (UCRL-Trans-843)

N

NAESER, C. R., Ground studies of radioactive wastes, 16: 25053 (TID-7628(p.237-47))

NAGEL, Bengt, K-shell photoelectric cross sections, 16: 24294

NAKACHE, F. R., Flux depression in foils, 16: 24362

NAKADA, Osamu, Polymerization of polyethylene by γ rays, 16: 23718 (AEC-tr-4321)

NAKAJIMA, Kiyoshi, Wear in shearing process by irradiated tools, 16: 24068

NAKAMICHI, M., Research on sand drift, 16: 24003

NALIBOFF, Y. D., Low-energy neutron spectra in D_2O and H_2O, 16: 24366

NAMETKIN, N. S., Polymerization of allylsilanes, 16: 23747

NANCE, R. D., Determination of sulfate adsorption by soils, 16: 23539

NARAYANAN, Krishnaswami, Heat transfer in baffled heat exchangers, 16: 23827

NARVER, David L., Jr., Mixes for steel coarse aggregate and limonite and magnetite matrix concretes, 16: 24231

NASH, J. B., Self-radiation oxidation of H-3, 16: 23717 (USNRDL-TR-565)

NASSIFF, S. J., Tellurium-121 isomeric pairs in Sb-121(d,2n) reaction, 16: 24786 (NP-11791)

NATA, P., Three-body Green's function for S-states, 16: 24733

NATHANS, M. W., Electronic energy levels and radiation of atoms in crystals, 16: 24290 (UCRL-Trans-399(L))

NAUMOVA, V. I., Separation of small quantities of Ce, 16: 23658

NAVRATIL, J., Preparation of UF_4 from UO_2, 16: 23679

NAZARENKO, V. A., Determination of Sc, 16: 23657

NECHAEVA, S. A., Increasing stability of polyolefin fibers by radiation, 16: 24255

NEERMAN, J., Gamma irradiation of p-substituted polystyrenes, 16: 23742

NEE TONG, Kia, Steam-pressurizer surge tank, 16: 24503

NEFEDOV, V. D., Isotope effects in β decay of Pb isotopes, 16: 23722 (AEC-tr-5150)

NEFEDOV, V. D., Synthesis of organic compounds of Po, 16: 23721 (AEC-tr-5149)

NEGANOV, V. I., Icebreaker "Lenin" in Arctic, 16: 25008

NEIDLINGER, R. W., Late manifestations of body radiation, 16: 23419 (UR-609)

NEILL, F. H., In-pile loop for EGCR, 16: 24987 (ORNL-TM-108)

NEIMARK, L. A., Recrystallization in ThO_2–UO_2 during irradiation, 16: 24037

NELKIN, M. S., TRIGA shutdown mechanism, 16: 24520

NELSON, D. J., Strontium, Sr-90, and Ca analysis of clams, 16: 23410 (ORNL-TM-270)

NELSON, Frederick, Packed-column techniques, 16: 23580

NELSON, G. B., Determination of W in Ta, 16: 23619 (TID-7629(p.55-61))

NELSON, G. B., Determination of Mo and W in Pu, 16: 23620 (TID-7629 (p.62-4))

NELSON, I. C., Prog. rpt. on evaluation of radiological conditions, 16: 23409 (HW-73366)

NELSON, J. L., Hanford studies in geochemistry, 16: 25052 (TID-7628 (p.214-36))

NELSON, R. W., Flow in porous media, 16: 25045 (TID-7628(p.130-44))

NELSON, Sterling L., Conservation of He by radio Ar measurements, 16: 24498

NEMCHENKO, V. F., Heat conduction of refractory borides, carbides, and nitrides, 16: 24208

NEMEC, E., Application of γ radiation in food industry, 16: 24061

NEMENOVA, N. M., Enterochromaffin cells of duodenum in acute radiation sickness, 16: 23519

NEMETH, Geza, Contamination from stack of reactor, 16: 25079

NEMETH, Geza, Theory of lattice damage in solids, 16: 24256

NEOGY, D., Crystalline electric field on Yb^{3+} ion, 16: 24304

NESMEYANOV, A. N., Isotope effect of Br recoil atoms in (n,γ) process, 16: 23723 (AEC-tr-5151)

NESMEYANOV, A. N., Synthesis of T-labeled cyclic hydrocarbons, 16: 23549

NEUBERT, H., Mechanical properties of refractory metals, 16: 24146 (ASD-TDR-62-11)

NEUERT, H., Particle discrimination with KI(Tl) scintillators, 16: 23956

NEUMANN, G. H., Mass number assignments and γ spectra of Sn and Sb isotopes, 16: 24805

NEUMANN, L., Preparation of UF_4 from UO_2, 16: 23679

NEUMANN, Michael J., Spark chamber for electronic data retrieval, 16: 23909

NEVITT, T. D., Radiation-induced alkylation of aromatics, 16: 24588

NEWBY, B. J., Precipitation process for Zr fuels. I., 16: 23782 (IDO-14582)

NIBLETT, G. B. F., Reversed field heating in thetatron, 16: 24886 (CLM-R-19)

NICHOLSON, R. B., Localized source multiplication and reactor startup, 16: 24405

NICHOLSON, R. B., Scattering resonances and reactor calculations, 16: 24387

NIELSEN, Joergen Tornoe, Preparation of O^{18}-labeled furan, 16: 23530

NIELSEN, Niels O., Lymphopenia produced by irradiation, 16: 23434 (BNL-6011)

NIESE, S., Application of activation analysis, 16: 23649

NIKITIN, Ju. P., Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)

NILAN, R. A., Efficiency of mutation induction, 16: 23469 (NAS-NRC-891)

NILAN, R. A., Radiation-induced recombination in octoploids, 16: 23454

NILAN, Robert A., Response of plant tissue to ionizing radiation, 16: 23451

NILSSON, A., Neutron angular distributions from $Be^9(\alpha,n)C^{12}$, 16: 24804

NILSSON, J., Forbidden weak interactions, 16: 24724

NIMIDOFF, D. A., Protons accelerated in 10-Bev synchrophasotron, 16: 24871 (UCRL-Trans-843)

NIMS, J. B., Fission neutron importance in fast reactor spectrum, 16: 24398

NISHIMURA, Hideo, Platinum–Mo alloys, 16: 24185 (AERE-Trans-884)

NISHIMURA, K., Landau curves for deuteron photodisintegration, 16: 24738

NITKA, H. F., Meaning of characteristic curves, 16: 23968 (ANL-6515 (p.87-101))

NOELL, Werner K., X-irradiation studies on retina, 16: 23501

NOELTING, J., Measurement of diffusion coefficients with method of radioactive surfaces, 16: 23704

NORDHAGEN, R., Proton bombardment of Al, 16: 24848

NORDHEIM, L. W., Resonance absorption in materials with grain structure, 16: 24394

NORINDER, O., Parameters for control rod cells, 16: 24930 (AE-75)

NORMAN, A., Production of void and pressure in solution reactor, 16: 24533

NORMAN, Ames, Radiation breakage of chromosomes, 16: 23465

NORMAN, H. H., CVTR controlled plant study, 16: 24972 (CVNA-138)

NOTZ, K. J., Measurement of low-surface-area U compounds, 16: 23640 (TID-7629(p.331-44))

NOVAK, L., Metabolic reactivity of irradiated organism, 16: 23422 (AEC-tr-5190)

NOVAK, Mary D., Phagocytin from x-irradiated rabbits, 16: 23462

NOVAK, Milan, Phagocytin from x-irradiated rabbits, 16: 23462

NOVATNY, P., Homogeneous reactor with suspended fuel, 16: 25003 (AEC-tr-5198)

NOVICK, R., Level crossing in (5s5p) $^3P_1$ state of Cd-111 and Cd-113, 16: 24850

NOVICK, R., Zeeman corrections for an (sl) configuration, 16: 24324

NOVIKOV, A. S., Effect of radiation on polymers, 16: 23756

NOVIKOVA, M. I., Disturbances in generative system following radiation sickness, 16: 23522

NOVOSELOVA, G. S., Protective effects of aminoethylisothiourea, 16: 23517

NOWAK, K., Elementary particles and photron theory, 16: 24714

NOWAK, K., Production of controlled nuclear fusion, 16: 24895

NOWAK, K., Project for controlled nuclear fusion, 16: 24896

NOWIK, I., Spectral shape of an incident Lorentzian wave packet, 16: 24754

NOYES, H. Pierre, Nucleon-nucleon dispersion relations, 16: 24751

NOYES, J. C., Biological shielding for radiation belt particles, 16: 24910

NOYES, R. C., Control of heat flow across an annulus, 16: 23821 (NAA-SR-Memo-7182)

NOYES, R. C., Pressure drop produced by rod bundle spacers, 16: 24279 (NAA-SR-Memo-6782)

NUKADA, Kenkichi, Extraction of $UO_2(NO_3)_2$ with TBP, 16: 23797

NULK, D. E., Vibratory compaction of UO_2 fuel elements, 16: 24621

NUNAMAKER, Thomas A., Time resolution of counter system, 16: 23915

(UCRL-9976)
NYBORG, P., Classical theories of spinning particles, 16: 24925
NYER, W. E., Shutdown mechanisms and reactor safety, 16: 24515
NYMAN, K., Parameters for control rod cells, 16: 24930 (AE-75)

O

OBA, Toro, Transistorized radiation monitors, 16: 23955
OBAYASHI, Tetsuzo, Acceleration of particles in outer atmosphere, 16: 24671
OBAYASHI, Tetsuzo, Geomagnetic storm effects on charged particles, 16: 24307
OBAYASHI, Tetsuzo, Solar geophysical events of November 1960, 16: 24306
OBOZNYI, V. A., Electron acceleration in annular synchrocyclotron, 16: 24866 (JINR-P-914)
OERDOEGH, Marie, Analysis of U, Th, and Zr, 16: 23653
OETVOES, L., Preparing C^{14}-labeled isocyanates, 16: 23557
OGDEN, Horace R., Prog. rpt. on coatings for Ta-base alloys, 16: 24148 (ASD-TR-61-676)
OKAMURA, Seizo, Primary radicals in vinyl polymerization, 16: 23738
OKAMURA, Seizo, Radiation polymerization of ring compounds, 16: 23744
O'KEEFE, J., Removing traces of radioactivity from water, 16: 25033 (AAEC/TM138)
O'KELLEY, G. D., Evaluation of U-233 fission yield data, 16: 24792 (ORNL-3305)
OKOLOVICH, V. N., Energy of fission products from U-235, 16: 24809
OLANDER, Donald R., Extraction of H_2O and HNO_3 by TBP–hexane, 16: 24646
OLIPHANT, Mark, Large homopolar generator, 16: 24877
OLIVE, D. I., Singularities of scattering amplitudes, 16: 24732
OLSEN, T. M., APWRC-SYBURN—program for burnup calculations, 16: 24944 (MND-C-2500-4)
OLSEN, T. M., APWRC-GAMICO—modification of GAM-I for PWR, 16: 24945 (MND-C-2500-5)
OLSEN, T. M., Code for static and dynamic synthesis of flux and reactivity, 16: 24943 (MND-C-2500-3)
OLSEN, T. M., Program and cross-section tape for PWR code, 16: 24094 (MND-C-2500-6)
OLSON, R. M., Detectors for space spectrometry, 16: 23928
OLSSON, Per, K-shell photoelectric cross sections, 16: 24294
OMBRELLARO, P. A., Calculating fast group diffusion theory parameters, 16: 24400
OMBRELLARO, P. A., Spatially dependent spectra, 16: 24370
O'NEILL, G. F., Bucklings and void effects in D_2O–UO_2 lattice, 16: 24414
ONSTOTT, E. I., Preparation of anhydrous lanthanon acetates by desolvation, 16: 23697
OPPENHEIM, I., Transport equations for upper atmosphere, 16: 23989 (ZPh-108)
ORBACH, Harry K., Effecting gas-stabilized electric arc reactions, 16: 23815
O'ROURKE, E. V., Uses of water injection to sub-surface through boreholes, 16: 25060 (TID-7628(p.374-9))
ORR, P. B., Purification of Pm-147, 16: 23786 (ORNL-3271)
ORSOS, Sandor, Radiochemical lab. at Veszprem, Hungary, 16: 23726 (JPRS-14324)
OSANOV, D. P., Dose of cylindrical source in presence of shield, 16: 24909
OSBORN, R. K., Analyses of probe-induced thermal flux perturbations, 16: 24360
OSBORNE, M. F., Beryllium-sheathed UO_2 fuel element irradiation, 16: 24613
OTTOMAN, Richard E., Radiation breakage of chromosomes, 16: 23465
OVERTON, T. R., Attenuation factors for tissues exposed to γ radiation, 16: 23459
OWEN, R. B., Pulse shape discrimination, 16: 23913
OZEROFF, W. J., Diffusion of charged particles in scattering medium, 16: 24676 (APED-3960)
OZEROFF, W. J., Diffusion of electrons in neutral gas, 16: 24272 (APED-3959)

P

PAGE, Earl M., Neutron filter for irradiation testing of fuel elements, 16: 24641
PAISOV, A. I., Non-aging low-carbon steel, 16: 24198
PAI VERNEKER, V. R., Indirect application of radioactive nuclei in analytical chemistry. II., 16: 23736
PAL, Lenard, Moderating parameters of "Dowtherm A", 16: 24774
PAL, Lenard, Statistical fluctuations of neutron multiplication, 16: 24775
PAL, Lenard, Theory of lattice damage in solids, 16: 24256
PALM, D., Isotope effects in labeled compounds, 16: 23577
PALMEDO, P. F., Flux distributions in U–D_2O lattices, 16: 24430
PALMER, A. R., Emission of fission product rare gases from UO_2–BeO and UO_2–ThO_2–BeO, 16: 24144 (AERE-R-4062)
PALMER, H. G., Photographic emulsion calibration, 16: 23847 (CTM-16-62(11))
PAMPUCH, R., Properties of the system ZrO_2–SiO_2, 16: 24210
PAN, C. H. T., Self-acting gas journal bearings, 16: 23805 (TID-15212)
PANEK, K., Neutron irradiation of chlorobenzene–benzene system, 16: 23719 (AEC-tr-5093)
PAPPALARDO, G., Nuclear reaction cross sections, 16: 24845
PAPPAS, A. C., Spallation of Cu with 24-Bev protons, 16: 24859
PARANJAPE, B. V., Electron–electron collisions in galvanomagnetic effects, 16: 24319
PARAZINSKAYA, N. V., Spark discharge in atmospheres of Ar and Xe, 16: 24289 (NP-tr-898)
PARECHANIAN, H. S., Prog. rpt. on refractory materials, 16: 24178 (WAL-TR-766-3/1-3)
PARKER, A., Barium in bones and foodstuffs, 16: 23370 (AERE-R-4035)
PARKER, James H., Jr., Ratio of diffusion coefficient to mobility coefficient for electrons, 16: 24281 (NP-11846)
PARKIN, Blaine R., Elastic wave calculations for Cowboy, 16: 23804 (RM-3105-AEC)
PARKINSON, T. F., Prog. rpt. on nuclear properties of Re, 16: 24789 (NP-11874)
PARSONS, H. W., Refining of U, 16: 23774 (NP-11877)
PASHININ, P. P., EPR and optical spectra for Yb^{3+} ions, 16: 24334
PASHOS, T. J., Irradiation tests of thin-wall stainless steel clad, UO_2 fuel rods, 16: 24618
PASTONESI, G., Instrumentation and automation in chemical and oil industry, 16: 24047
PATAKI, L., Solvent effect in exchange reaction, 16: 23573
PATHAK, K. M., Ejection of Li-9 hammer track, 16: 24827
PATRO, A. P., Decay of Sb-113, 16: 24832
PATTERSON, John F., Bubbling two-phase mixture, 16: 24510
PAULSON, A. E., Control programming method for ATR, 16: 24548
PAVLOVSKAYA, V. S., Work hardening of Cu by nuclear resonance, 16: 24214
PAXTON, Hugh C., Los Alamos fast critical program, 16: 24358
PEACOCK, D. E., Point defects in Nb, Mo, and Ta, 16: 24258
PEAKE, Neil G., Roller x-ray spectrometer, 16: 23948
PEARCE, D. W., Waste management program, IAEA, 16: 25076 (TID-7628 (p.590-601))
PEASE, S., Preventing resonance discharge in cavity resonator, 16: 24889 (AERE-Trans-890)
PECK, C. Clyde, Pion-pion interactions, 16: 24748
PECKHAM, A. E., Radioactive waste burial sites, 16: 25063 (TID-7628 (p.428-36))
PEDRETTI, Alberto, Progress on Italian organic reactor program, 16: 24604
PEISL, Hans, Color center formation in irradiated LiF, 16: 23766
PELETIER, L. A., MHD viscous flow problems, 16: 24894
PELT, G., Properties of n^+-i-p^+ semiconductor detector, 16: 23896
PENELLE, G., Maximum credible accident of BR-2 reactor, 16: 25014 (BLG-99)
PENG, Chi-jui, Fenghuangite, 16: 23997
PERESLEGIN, I. A., Radiation sickness of newborn rats and remote sequelae, 16: 23523
PERETTE, J., Radioisotopes and their applications, 16: 24051
PEREZ, Baldomero Lopez, Solvent extraction of Nd and Pm, 16: 23788

(ORNL-TM-184)
PERKINS, Frank C., Oxidation of beryllides, 16: 24123 (TID-16030)
PERKINS, J. F., Transport of fast electrons, 16: 24746
PERL, Martin L., Pion-pion interactions, 16: 24748
PERLEE, Henry E., Hazards in use of liquid H in bubble chambers, 16: 24015 (TID-15985)
PERONA, J. J., Evaluation of ultimate disposal methods, 16: 25072 (TID-7628(p.532-5))
PERRY, Alfred M., Sensitivity of reactivity lifetime to fission-product cross sections, 16: 24384
PERSSON, Karl-Birger, Decay of conductivity in high electron density, 16: 24881 (AFCRL-1119)
PESHKOV, E. V., Radiation-induced changes in salt crystals, 16: 24267
PETERLONGO, G., Wet steam cooling experiments, 16: 23816 (EURAEC-47)
PETERSEN, D. F., Estimation of fast neutron doses in man, 16: 23379 (TID-7616(p.89-97))
PETERSEN, G. T., Thermal utilization—spatially dependent spectra, 16: 24425
PETERSON, E. G., Shielding studies for power reactor, 16: 24593
PETERSON, J. P., Jr., Half life of Cs-137, 16: 24566
PETERSON, M. B., Surface films in lubrication, 16: 23803 (R60GL185)
PETERSON, R. E., Nuclear control characteristics of PRTR, 16: 24537
PETERSON, Ronald G., Mechanical vibrations in solid rods, 16: 23972 (AKL-6515(p.133-61))
PETRASHKU, M. G., Anomalies in μ^- meson decay in nuclei, 16: 24278 (JINR-P-971)
PETROSYAN, S. L., Radiation sickness of newborn rats and remote sequlae, 16: 23523
PETRUKHIN, V. I., Conserved vector current hypothesis, 16: 24691 (JINR-P-968)
PETRUKHIN, V. I., Detection of charge exchange in π^- mesons, 16: 24689 (JINR-P-948)
PETRZILKA, Vaclav, Cosmic rays, 16: 24673
PETZOW, Guenter, Constitution of U–Si–Al alloys, 16: 24217
PFIRSCH, D., Electrostatic stability of non-Maxwellian plasma, 16: 24900
PHILLIPS, Harold O., Packed-column techniques, 16: 23580
PICKETT, A. G., Cyclic pressure tests of pressure vessels, 16: 23807 (TID-15979)
PICKWICK, Fred, Jr., Ion exchange studies on acid leach liquor, 16: 23772 (ACCO-37)
PIETRI, G., Photomultipliers in experimental physics, 16: 23863
PIETRI, G., Photomultiplier tubes for scintillation counting, 16: 23886
PIHAN, J.-M., Adiabatic waves in plasma, 16: 24880 (AFCRL-896(Pt.II))
PUCK, J., Detection of trace metals in biological materials, 16: 23403
PINERO, R. Barrera, Analytical control of polyphenylic mixtures, 16: 23603 (JEN-91-DQ/I-25)
PIROUE, P. A., Particle production by protons, 16: 24858
PIVOVAROV, V. E., Extraction of U and rare earths, 16: 23793
PLANO, R., Parity of the neutral pion and decay, 16: 24749
PLASTINO, G. G., Observations of SL-1 incident effects, 16: 24513
PLASTINO, Gene G., Decontamination of D140E-1 power plant, 16: 24976 (DC-60-10-726)
PLATZEK (PLATZEC), P., Suitable isotope and source strength for mass difference problem, 16: 23860 (CEA-tr-A-1122)
PLESCH, Rolf, Release of radioactive materials in waste water channels, 16: 25077
PLOUGH, H. H., Genetic effects of radiation, 16: 24559
PLUMMER, G. E., Geometry and attenuation generated by vertical slab exposed to Co-60 source, 16: 24603
PODESVA, S., Preparation of UF_4 from UO_2, 16: 23679
POGLASOWA, M. N., Sterilization of food products by irradiation, 16: 24042
POGOSYAN, R. I., Electric reaction of retina in action of γ rays, 16: 23437
POGOSYAN, R. I., Sensitivity of skin chromatophores to radiation, 16: 23444
POLAK, L. S., Polymerization of allylsilanes, 16: 23747
POLAKOWSKI, N. H., Fabrication of small-diameter Zr alloy tubing, 16: 24634
POLOWINSKI, S., Peroxides of polymethyl methacrylate, 16: 23743
POLUBOYARINOV, D. N., Technology of molding Zr objects, 16: 24138
POLVANI, C., Fall-out in milk in Milan, 16: 24023
PON, G. A., Economic analysis of organic-cooled reactors, 16: 24453
PONCELET, C. G., Reactivity calculations in Yankee Core I, 16: 24471
POPOV, P. I., Protection systems for reactors, 16: 24954
POREMBKA, Stanley W., Prog. rpt. on USAEC/AECL cooperative program, 16: 24149 (BMI-X-204)
PORGES, K. G., Rejection of γ background pulses in Hornyak buttons, 16: 23916 (UAC-6092)
PORTER, L. L., EOCR experimental projects, 16: 25019 (IDO-16761(p.75-97))
POSCHET, H. J., Nitrogen isotope separation during HNO_3 production, 16: 24079
POSEY, J. C., Recovery of irradiated U by extraction procedure, 16: 24647
POSPISHIL, M., Metabolic reactivity of irradiated organism, 16: 23422 (AEC-tr-5190)
POULOS, N. E., Prog. rpt. on high temperature ceramics, 16: 24132 (NP-11713)
POULTNEY, Sherman K., Focusing Cherenkov counters, 16: 24696 (NP-11880)
POWELL, Carroll F., Prog. rpt. on coatings for Ta-base alloys, 16: 24148 (ASD-TR-61-676)
POWERS, E. L., Survival curves and target theory, 16: 23458
PRATT, C. A., Refractory metal alkoxides, 16: 24147 (ASD-TDR-62-90)
PRAVEDNIKOV, A. N., Radiolysis of polystyrene, 16: 23546
PRAVEDNIKOV, A. N., Radiolysis of polymers, 16: 23745
PRESCOTT, J. R., Resolution in scintillation counters, 16: 23881
PRICE, G. A., Diffusion parameters of graphite and graphite–Bi, 16: 24375
PRICE, Glen A., Reactor parameters in subcritical and critical assemblies, 16: 24354
PRICE, N. H., Design of shock tube, 16: 24275 (CLM-R-18)
PRIMEAU, D. B., Economic analysis of organic-cooled reactors, 16: 24453
PRODELL, A., Parity of the neutral pion and decay, 16: 24749
PROESCH, U., Radiolysis of liquid ammonia, 16: 23767
PROFIO, A. E., Flux distribution in cavity assembly, 16: 24428
PROFIO, A. E., Flux distributions in U–D_2O lattices, 16: 24430
PROFIO, A. E., Measurements of U-238 capture and fast fission, 16: 24429
PROIS, Kh., Photoeffect from photocathodes under x rays, 16: 24328
PROKHOROV, A. M., EPR and optical spectra for Yb^{3+} ions, 16: 24334
PROKOSHKIN, Yu. D., Conserved vector current hypothesis, 16: 24691 (JINR-P-968)
PROKOSHKIN, Yu. D., Detection of charge exchange in π^- mesons, 16: 24689 (JINR-P-948)
PROSPERI, G. M., S matrix in angular momentum, 16: 24743
PROTSENKO, V. P., Parameters for gas-cooled atomic power stations, 16: 25007
PROUT, W. E., Containment of radioactive wastes in underground caverns, 16: 25061 (TID-7628(p.380-95))
PRUVOST, N., CONEC—coupled neutronics theory code, 16: 24438
PUGACZ, M. A., Design data on Inconel X, 16: 24151 (DC-61-2-133)
PULACCI, A., Television camera for Ispra-1 control room, 16: 25015 (CNEN-134)
PURIKA, I., Thermal columns for amplifying fluxes in water-moderated reactors, 16: 24955
PURKAYASTHA, B. C., Indirect application of radioactive nuclei in analytical chemistry. II., 16: 23736
PUROHIT, S. N., Polynomial method in study of thermal neutron spectrum, 16: 24377
PYKA, M., Ionization effects in spark chambers, 16: 23908

Q

QUEMADA, D., Adiabatic waves in plasma, 16: 24880 (AFCRL-896(Pt.II))
QUIGLEY, Henry C., Irradiation of U–2% Zr fuel tube, 16: 24237 (DP-709)
QUINLAN, W. J., Late manifestations of body radiation, 16: 23419 (UR-609)
QURESHI, S. A., Radiation-induced recombination in octoploids, 16: 23454

R

RAAYMAKERS, W. A., Computer applied to reactor burnup studies, 16: 24942 (KR-20)
RABOUR, C., Alpha spectrometry using junction detectors, 16: 23840 (CEA-2138)

RADO, R., Cross-linking of polyethylenes, 16: 23542
RAE, E. R., Variation of η/ν for U-235, 16: 24790 (NRDC-123)
RAFAL'SKI, Volin, Separation of Th from molten salts, 16: 23672 (PAN-287/IV)
RAGAN, Nancy, Effects of radiation on neonatal brain, 16: 23477
RAINEY, R. H., Extraction of Nb-95 from HNO$_3$ solutions, 16: 23787 (ORNL-3285)
RAKINTZIS, Nikolaus, Radiation chemistry of aqueous solutions. I., 16: 23768
RAMDOHR, H., Radionuclides and radiation in processing, 16: 23728
RAMES, M., Grains of P-32 used for clinical purposes, 16: 23365
RANDALL, R. L., Reactor power spectrum measurements, 16: 24538
RANG, H. J., Radiation effects on monomers and polymers, 16: 23727
RANZ, William E., Mass and heat transfer rates, 16: 23822 (NP-11818)
RAO, Chillapalli Venkata, Effect of local boiling on heat transfer, 16: 23628
RASKOVIC, D., Lipids in normal state, after irradiation, and in leukemia, 16: 23447
RASMUSSEN, N. C., Investigation of subcritical assemblies by pulsed neutron source technique, 16: 24424
RASMUSSEN, Norman C., Radiations from spent fuel elements, 16: 24352
RASO, D. J., Monte Carlo calculations of γ radiation, 16: 24598
RATTI, S., Beta decay of negative muon, 16: 24725
RAY, J. H., Fast neutron cross sections, 16: 24796 (UNC-5002)
RAYMOND, John E., Geohydrologic features affecting waste disposal, 16: 25042 (TID-7628(p.77-98))
RAZAFIMALAZA, Justin Manambelona, Gold-198 and I-131 in diagnosis of hepatic affections, 16: 23371 (CEA-1994)
READ, A. H., Diffusion of electromagnetic fields, 16: 23834 (AERE-M-1014)
REAGAN, J. B., Scintillation counters for space radiation, 16: 23927
REALE, A., Photoproduction in H of ω^0 meson, 16: 24680 (ISS-61/41)
REARDON, W. A., Critical mass experiments with Pu(NO$_3$)$_4$, 16: 24416
REARDON, W. A., Experience in Hanford Pu critical mass facility, 16: 24417
REAVIS, J. R., Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)
REBA, Richard C., Measurement of Hg-203 chlormerodrin accumulation by kidneys, 16: 23400
REBELLO, W. J., Corrosion effects on heat transfer through tubes, 16: 24127
REED, G. A., Yankee plant and reactor performance, 16: 24467
REED, L. D., Energy resolution of NaI scintillators, 16: 23882
REESE, William, Magnetic properties of He-3, 16: 24284 (TID-15973)
REGENSTREIF, E., CERN proton synchrotron. III., 16: 24865 (CERN-62-3)
REGGE, T., Potential scattering for complex energy, 16: 24310
REICHERT, S. O., Disposal of radioactive wastes to ground, 16: 25044 (TID-7628(p.115-29))
REIK, H. G., Hot electrons in n Ge, 16: 24323
REISENAUER, A. E., Flow in porous media, 16: 25045 (TID-7628(p.130-44))
REME, H., Reaction $Si^{28}(n,\alpha)Mg^{25}$, 16: 24846
REMESSOVA, T. S., Resistance of yeasts to radiation, 16: 24043
RENNER, Kh., Field boundary and scatter radiation, 16: 24026
REUSSE, W., Detection of cable defects by radioisotopes, 16: 24062
REXED, Bror, Local irradiation of central nervous system with high-energy protons, 16: 23489
REYNOLDS, A. B., Analysis of Mixed Spectrum Superheater, 16: 24474
REYNOLDS, G. T., Observing photoelectrons in image istensifiers, 16: 23906
REYNOLDS, Jean H., Prog. rpt. on nuclear engineering, 16: 23352 (BNL-705)
REYNOLDS, M. B., Materials for nuclear superheat applications, 16: 24155 (GEAP-3875)
REYNOLDS, S. A., Radioreagent techniques, 16: 24575
REYNOLDS, Thaine W., Critical temperature for surface ion currents, 16: 24280 (NASA-TN-D-1307)
RHOADES, W. A., ULCER and QUICKIE—diffusion theory programs, 16: 24436
RICAMO, R., Nuclear reaction cross sections, 16: 24845
RICE, Charles M., Neutronic reactor, 16: 24958
RICE, W. W., Mass spectrometer analyzer tube assembly, 16: 23857 (Y-1393)
RICHARDSON, Harold E., Jr., Radiation effects on blood-brain barrier, 16: 23493
RICHARDSON, R. M., Burial ground studies, 16: 25065 (TID-7628 (p.460-1))
RICHERT, R., Technique of fast coincidences, 16: 24801
RICHEY, C. R., Determination of k_∞ for U-235 enriched UO$_2$, 16: 24434
RICHIUSA, C. C., Prog. rpt. on organic coolant reclamation, 16: 24940 (IDO-11052)
RICHTER, Harold G., Radiometric technique for determination of O in waters, 16: 24577
RICHTER, W., High-voltage devices for operation of nuclear equipment, 16: 23945
RICKERT, R. J., Control and transients of self-pressurized water reactor, 16: 24532
RIDDIFORD, L., Meson production in H, 16: 24719
RIDER, B. F., Half life of Ca-137, 16: 24566
RIEDESEL, M. L., Physiological indices of strain, 16: 23376 (TID-7616 (p.61-8))
RIESE, Gretchen R., Studies of U–Th–C system, 16: 24180 (AEC-tr-5179)
RIEZLER (RIESLER), W., Electrostatic filter for radioactive aerosols, 16: 24021 (CEA-tr-A-1002)
RILEY, D., Conceptual design of Mixed Spectrum Superheater, 16: 24473
RIMONDI, C., Teleocsium therapy, 16: 23399
RINALDI, R., Action of x-rays on plasma proteins, 16: 23412 (CEA-2132)
RINNE, Robert William, Movement of isotopes in peppermint, 16: 23389
RINNOVATORE, James V., Transition phase in Mg–Li–Al–Zn alloy, 16: 24164 (NP-11778)
RIOPELLE, Arthur J., Behavioral effects of radiation, 16: 23513
RISKEN, H., Hot electrons in n Ge, 16: 24323
RISTI, H. A., Parameters by Cd ratio technique, 16: 24426
RITCHIE, R. H., Proton recoil energy loss distribution, 16: 24791 (ORNL-3089)
RITZMANN, R. W., Potential of small power reactors, 16: 24476
RIVERA, Joseph, Prog. rpt. on fall-out program, 16: 24012 (HASL-127)
ROACH, D. B., Properties of Mar-Aging steels, 16: 24153 (DMIC-Memo-138)
ROBBA, William A., Status of settled bed fast reactor, 16: 24481
ROBBINS, C. H., Analyses of radial separator, 16: 24936 (GEAP-4012)
ROBERTS, B. F., In-pile melting of UO$_2$ fuel, 16: 24615
ROBERTS, Dale W., Gnome temperature and radiation studies, 16: 23356 (PNE-106P)
ROBERTS, F. P., In-cell γ analyzer, 16: 23618 (TID-7629(p.42-53))
ROBERTS, I. C., Waste management program, IAEA, 16: 25076 (TID-7628 (p.590-601))
ROBERTS, J. E., Blast effects in shelters on animals and dummies, 16: 24017 (WT-798)
ROBERTS, J. T., Evaluation of ultimate disposal methods, 16: 25072 (TID-7628(p.532-5))
ROBERTS, R., Radiation vulcanization of hydrocarbon polymers, 16: 24284
ROBERTS, W. J., Monte Carlo evaluation of fast neutron collimators, 16: 24905 (NAA-SR-Memo-7347)
ROBERTS, W. J., Temperature coefficients in ZrH moderated reactors. I, 16: 24380
ROBERTS, W. J., Temperature coefficients in ZrH moderated reactors. II, 16: 24381
ROBERTS, William J., Monte Carlo calculations for SNAP reactor shields, 16: 24595
ROBERTSHAW, J. E., Surface analysis by nuclear particle scattering, 16: 24568
ROBERTSHAW, J. E., Surface composition based on nuclear bombardment data, 16: 24569
ROBERTSON, C. S., Jr., Design technology for GCR. I-III., 16: 24967 (APEX-800(Pt.A))
ROBERTSON, J. A. L., Properties of ceramic fuels, 16: 24606
ROBERTSON, M. M., Photographic emulsion calibration, 16: 23847 (SCTM-16-62(11))
ROBERTSON, R. F. S., Radiation of SAP-clad UO$_2$ fuel, 16: 24458
ROBINSON, J. M., Critical heat flux of Santowax R, 16: 24947 (NAA-SR-Memo-6907)
ROBINSON, L. B., Multipurpose readout scaler, 16: 23842 (CREL-952)
RODENBERG, Rudolf, Form factors for electron-nuclei scattering, 16: 24862

RODENBERG, Rudolf, Inelastic electron to positron scattering on nuclei, 16: 24863
ROEHRS, R. J., Production of UO_2, 16: 23773 (MCW-1470)
ROEMER, Gunter, Scintillation measuring equipment, 16: 23946
ROGERS, W. B., Jr., Exponential measurements in D_2O–U lattices, 16: 24415
ROGOVIN, Z. A., Increasing stability of polyolefin fibers by radiation, 16: 24255
ROHSENOW, Warren M., Forced-convection surface-boiling heat transfer, 16: 23823 (NP-11831)
ROITER, V. A., Kinetics of $SO_3 + 0.5\ O_2 \rightleftharpoons SO_3$, 16: 23584
ROJO-ASENJO, Onofre, Two-nucleon scattering, 16: 24708
ROLLINS, F. R., Ultrasonic propagation in deformed materials, 16: 23971 (ANL-6515(p.121-32))
ROONEY, K. L., Monte Carlo evaluation of fast neutron collimators, 16: 24905 (NAA-SR-Memo-7347)
ROONEY, Kevin L., Monte Carlo calculations for SNAP reactor shields, 16: 24595
ROOS, C. E., Lepton conservation using isotopic displacement, 16: 24742
ROOS, Matts, Low-energy K^--nucleon scattering, 16: 24704
ROPP, G. A., Photochemical reactions of formic-d acid, 16: 23567
ROSE, D. J., Concepts for steady-state fusion reactor, 16: 24444
ROSE, David, Containment vessel studies for HTGR, 16: 24489
ROSE, Jerzy E., Lesions in cerebral cortex by deuteron irradiation, 16: 23490
ROSE, M. E., Foldy-Wouthuysen and Lorentz transformations, 16: 24736
ROSEN, Nathan, Quantum geometry, 16: 24920
ROSENBLUM, C., Stability of vitamin B_{12}–Co^{60} content of liver, 16: 23397 (BNL-4885)
ROSENBLUM, Cynthia, Determining tritium water in urine, 16: 23642 (UCLA-504)
ROSENFELD, Arthur H., Pion-pion interaction, 16: 24750 (UCRL-9814)
ROSESCU, T., Thermal columns for amplifying fluxes in water-moderated reactors, 16: 24955
ROSKIES, R., Neutron absorption in composite cylinder, 16: 24760 (CRT-1079)
ROSS, A. E., Determination of burnup, 16: 23627 (TID-7629(p.166-76))
ROSS, Wayne L., Neutronic reactor, 16: 24958
ROSSI, H. H., Radiation in shelters and instrumentation, 16: 24016 (WT-789)
ROSSIN, A. D., Radiation damage dose rates in reactor spectra, 16: 24636
ROTH, D., Ionization effects in spark chambers, 16: 23908
ROTH, R. F., Scintillation counter K^+ bubble chamber, 16: 23919
ROTHE, E. D., Detector for γ-ray astronomy experiment, 16: 23926
ROTHSTEIN, A., Interaction of Hg with erythrocytes, 16: 23393
ROTHWELL, E., Substoichiometry in UO_2, 16: 24610
ROUGH, F. A., In-pile fission gas release from UO_2, 16: 24614
ROURKE, Francis M., Solid-sample mass spectrometry, 16: 23625 (TID-7629(p.142-50))
ROUSSANOV, A. M., Protective effects of aminoethylisothiourea, 16: 23517
ROUSSEAU, Pierre, High-temperature microscope, 16: 23839 (CEA-2082)
ROUT, V. M., Angular distributions in $N^{14}(d,p)N^{15}$, 16: 24841
ROUX, D. P., Fission chamber and preamplifier assembly for high-flux, 16: 24552
ROWAN, J. H., Direct-reading Be air monitor, 16: 23615 (TID-7629(p.16-21))
ROWAN, J. H., Spectrograph for detection of Be, 16: 23614 (TID-7629 (p.1-15))
ROWAND, R. R., Ultrasonic propagation in deformed materials, 16: 23971 (ANL-6515(p.121-32))
ROWLAND, John F., Binary system CaO–Nb_2O_5, 16: 24191
ROY, D. N., Energy-dependent neutron transport problem, 16: 24769 (AEC-tr-5204)
ROY, L. P., Separation factor of H isotopes, 16: 24078
ROY, R. R., Prog. rpt. on nuclear physics, 16: 24794 (TID-15211)
ROYAULT, Pierre, Radioisotopes for inspection of gas mains, 16: 24060
RUBCHINSKII, S. M., Design of 7-Bev proton synchrotron, 16: 24872
RUBIN, B., Irradiation behavior of ZrO_2–UO_2 fuels, 16: 24616
RUCH, T. C., Effects of radiation on behavior and blood, 16: 23511
RUDSTAM, G., Spallation of Cu with 24-Bev protons, 16: 24859
RUDY, E., Studies of U–Th–C system, 16: 24180 (AEC-tr-5175)
RUGH, Roberts, Effects of radiations on embryo and fetus, 16: 23472
RUHL, E. W., Shelter instrumentation, 16: 23856 (WT-790)
RUIZ, C. P., Half life of Cs-137, 16: 24566
RUMSH, M. A., Photoeffect from photocathodes under x rays, 16: 24328
RUSIN, S. P., Heat conduction coefficient of graphite, 16: 24209
RUSSELL, J. L., Jr., Absorber bumup experiment, 16: 24486
RUSSELL, J. L., Jr., Calculational models of diffusion length, 16: 24373
RUTHERFORD, J. A., Ion-neutral collisions in afterglow, 16: 24276 (GA-2824)
RUTHERFORD, J. J. B., Evaluation of superheater tube alloys, 16: 24126
RYABCHIKOV, D. I., Separation of small quantities of Ce, 16: 23658
RYAN, C., Doublet scheme for leptons, 16: 24694 (NP-11731)
RYAN, G., Properties of n^+-i-p^+ semiconductor detector, 16: 23896
RYDBERG, Jan, Determination of complex equilibria, 16: 23583
RYKALIN, V. I., Conserved vector current hypothesis, 16: 24691 (JINR-P-968)
RYKALIN, V. I., Detection of charge exchange in π^- mesons, 16: 24689 (JINR-P-948)
RYUKHIN, Yu. A., Isotope effects in β decay of Pb isotopes, 16: 23722 (AEC-tr-5150)

S

SABAU, M., Thermal columns for amplifying fluxes in water-moderated reactors, 16: 24955
SACHDEV, R. M., Calibration of GM counters for Ra, 16: 23833 (AEET/AM/24)
SACHS, H. L., Infrared physics, 16: 23973 (ANL-6515(p.163-86))
SADOVSKAYA, G. K., Structure of polyethylene terephthalate, 16: 23746
ST. ROMAIN, F. A., Neutrons from reaction $Be^9(\alpha,n)C^{12}$, 16: 24852
SAITO, Katsuyoshi, Transistorized radiation monitors, 16: 23955
SALDINGER, I. L., Properties of W, Ta, and Mo, 16: 24162 (NP-11654)
SALEM, Semo'an I., Roller x-ray spectrometer, 16: 23948
SALING, J. H., High-temperature irradiation of UO_2–BeO bodies, 16: 24623
SALISBURY, Stanley Roger, Elastic scattering of protons on O, 16: 24823
SALZANO, Frank J., Absorption and diffusion of Xe, 16: 23700
SALZMAN, John Daniel, Dissolution of U in nitric acid, 16: 23536
SAMA, L., Prog. rpt. on coatings for Ta-base alloys, 16: 24163 (NP-11711)
SAMEC, Maks, Production of modified starches by γ rays, 16: 23750
SAMIOS, N. P., Parity of the neutral pion and decay, 16: 24749
SAMPSON, J. B., Accurate computation of Doppler broadening, 16: 24393
SAMPSON, J. B., Resonance absorption in materials with grain structure, 16: 24394
SAMSONOV, G. V., Heat conduction of refractory borides, carbides, and nitrides, 16: 24208
SANDERS, D. G., Superheat cycle for H_2O-moderated and -cooled reactors, 16: 24475
SANDERSON, R. J., Control and transients of self-pressurized water reactors, 16: 24532
SANDERSON, Robert J., Thermal testing of UO_2 fuel elements, 16: 24620
SANDOR, T., Muon component of cosmic radiation, 16: 24670
SANDRET, F., Action of γ rays on flour, 16: 24041
SANGIUST, V., Disintegration of Sr-82, 16: 24812
SANNIER, J., Oxidation of Nicral D and Hastelloy X, 16: 24124 (AEC-tr-5235)
SARA, R. V., Prog. rpt. on metal carbides, 16: 24798 (WADD-TR-60 143(Pt.III))
SARACENO, F. Squadrelli, Uranium alloys containing Mo and C, 16: 24150 (CNEN-113)
SARSUNOVA, M., Application of β backscattering for control of ointments and pastes, 16: 24065
SASMORE, Daniel P., Acute central nervous system syndrome of burns, 16: 23498
SATA, Toshio, Wear in shearing process by irradiated tools, 16: 24068
SATLOW, G., Effect of radiation on wools, 16: 24257
SATO, Makoto, Effects of radiation on spinal neurons, 16: 23502
SATYCHEV, V. M., Plasma current, 16: 24901
SAUDINOS, Joan, Nuclear excitation by α scattering, 16: 24777 (CEA-2146)
SAUER, J. A., Studies of irradiated polypropylene, 16: 24253
SAUER, Kenneth W., Neutronic reactor, 16: 24958
SAUER, Mary Elmore, Cytoplasmic DNA in irradiated neutral tube, 16: 23476
SAUNDERS, Edward M., Ground state of solid He-3, 16: 24322
SAUSVILLE, J. W., Analysis of dense BeO, 16: 23624 (TID-7629(p.135-

41))
SAUVAGNAC, R., Determination of impurities in Cs-137, 16: 23631 (TID-7629(p.209-16))
SAVINTSEV, P. A., Mutual solubility of metals, 16: 24181 (AEC-tr-5177)
SAVITSKII, E. M., Effect of Re on Co–Cr–Mo–Ni alloy, 16: 24200
SCALETTAR, R., TRIGA shutdown mechanism, 16: 24520
SCARL, D. B., Observing photoelectrons in image intensifiers, 16: 23906
SCARL, Donald B., Measurement of rate for $\mu^- + C^{12} \rightarrow B^{12} + \nu$), 16: 24788 (NP-11796)
SCARLETT, Radiation-resistant lubricants, 16: 24247
SCARPELLI, Dante G., Changes in irradiated nerve cells, 16: 23494
SCHAER, J., Covariant spin affine connection, 16: 24926
SCHAMBERGER, R. D., Effective fast neutron removal cross section, 16: 24797 (WADC-TR-58-266)
SCHAMBERGER, R. D., k_∞ Measurements of UO_2–D_2O lattices, 16: 24427
SCHATENSTEIN, A. I., Isotopic analysis of waters, 16: 23661
SCHEER, K., Late manifestations of body radiation, 16: 23419 (UR-609)
SCHENKEL, Frederick W., Photoemissive tubes, 16: 23888
SCHIEBOLD, E., Agfa-Texo-F film in testing with γ rays, 16: 23977
SCHIFF, Herman H., Ion exchange recovery of U, 16: 23778 (ACCO-44)
SCHIFFER, J. P., Measurements of Cu(p,n) cross sections, 16: 24793 (TID-12696)
SCHILDKNECHT, H., Tritium-labeled polyphenols, 16: 23553
SCHJEIDE, O. A., Effects of radiation on neonatal brain, 16: 23477
SCHLEGELMILCH, F., Tritium-labeled polyphenols, 16: 23553
SCHLEICH, K., Vapor pressure of SO_3 and SO_3^*, 16: 23693
SCHLENK, F., Alkaline hydrolysis of S-adenosylmethionine, 16: 23729
SCHLOTE, Wolfgang, Effects of x rays on central nervous system, 16: 23482
SCHMALZ, Bruce L., Waste disposal practices, 16: 25073 (TID-7628 (p.536-68))
SCHMIDT, F. A., Yttrium, 16: 24201 (IS-222)
SCHMIDT, G. B., Breaking chemical bonds in bromo- complexes by isomeric transitions, 16: 23764
SCHMIDT, R. E., Fuel element cracking, 16: 24934 (DC-60-11-103)
SCHMIDT, Robert G., Aeroradioactivity survey and geology of Hanford area, 16: 23983 (CEX-59.4.11)
SCHMIDT-LORENZ, A., Surface pasteurization by soft x rays, 16: 24036 (AEC-tr-5096)
SCHMITZ, F., Fission product diffusion in nuclear fuels, 16: 24183 (AEC-tr-5206)
SCHNEER, Anne, Analysis of U, Th, and Zr, 16: 23653
SCHNEIDER, W. G., NMR investigation of molecular complexes, 16: 23533
SCHOLZ, Willibald, Effects of x rays on central nervous system, 16: 23482
SCHONFELD, Ernest, Head-end treatment of low level wastes, 16: 25036 (ORNL-TM-260)
SCHOTTLANDER, Marianne, Preparation of O^{18}-labeled furan, 16: 23530
SCHRADER, E. W., Startup portable nuclear power station, 16: 24494
SCHRANZ, P., Magnetic amplifier in reactor instrumentation, 16: 23861 (CEA-tr-A-1126)
SCHREIBER, Richard E., Stresses in stainless steel during irradiation, 16: 24236 (DP-669)
SCHUBERT, Gerhard, Scintillation measuring equipment, 16: 23946
SCHUCH, R. L., Linear composition by scintillation spectroscopy, 16: 23930
SCHUERENKAEMPER, A., Bench loop for study of pre-irradiated samples, 16: 24106 (EURAEC-57(App.9))
SCHUETZE, H. J., High-frequency mass spectrometer, 16: 23954
SCHUHL, Claude, Cross sections in neutron photoproduction, 16: 24778 (CEA-2148)
SCHULDINER, S., Electrode processes survey, 16: 23671 (NRL-5775)
SCHULEK, E., Solvent effect in exchange reaction, 16: 23573
SCHULTE-FROHLINDE, Dietrich, Radiation chemistry of aqueous solutions. I., 16: 23768
SCHUMACHER, David P., Polymorphic transition in LiH, 16: 24205
SCHUMANN, W. A., Fuel handling machine shielding, 16: 24948 (NAA-SR-Memo-7212)
SCHUMMELFEDER, Norbert, X-ray damage in cerebellum, 16: 23481
SCHWARTZ, M., Parity of the neutral pion and decay, 16: 24749
SCHWARTZ, Milton, Transition phase in Mg–Li–Al–Zn alloy, 16: 24164 (NP-11778)
SCHWARTZ, Robert, Radiative and antiglobulin test, 16: 23435
SCHWEITZER, D. G., Liquid metal fuel constitutions. III., 16: 24216
SCHWEMIN, Arnold J., SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)
SCOCCIANTI, P., Accretion rate of bone in vertebrae, 16: 23394
SCOLA, D. A., Prog. rpt. on organic coolant reclamation, 16: 24940 (IDO-11052)
SCOLA, D. A., Reclamation of organic nuclear reactor coolant, 16: 24482
SCOLES, G., Vapor pressure of isotopic solids, 16: 24311
SCUDERI, T. G., Thermal expansion of Al_2O_3 and ThO_2, 16: 24190
SCUTT, R. A., Spatial kinetics of reactors, 16: 25004 (AERE-Trans-888)
SEABORG, Glenn T., Spallation-fission competition in At, 16: 24354
SEABORG, Glenn T., Transcurium and transactinide elements, 16: 24339
SEDEL'NIKOV, T. Kh., Spectrum of slowing-down neutrons, 16: 24773
SEFCHOVICH, E., In-pile irradiation of Santowax OMP, 16: 24455
SEGALMAN, I., Thermal analysis of Type 3 elements, 16: 24965 (APAE-105)
SEGRE, G., Human pulmonary circulation, 16: 23395
SELENGUT, D. S., Transport corrections to diffusion theory, 16: 24371
SEMENOVA, N. K., Isotope effect in H exchange reactions, 16: 23569
SENVAR, Cemil B., Chemical dosimetry of γ rays, neutrons, and accelerated electrons, 16: 23732
SERBAN, D., Radiations in purifying used waters, 16: 24054
SERLEMITSOS, P., Spectrometer to search for positrons in space, 16: 23924
SERMENT, V., Gamma irradiation of p-substituted polystyrenes, 16: 23762
SERRA, A., Pulse scalers and preselectors, 16: 23845 (NP-11734)
SHAFFER, J. H., Reactions in molten fluoride media, 16: 23595
SHAFFER, P. T. B., Thermal shock resistance of ceramic bodies, 16: 24176 (WADD-TR-60-749(Pt.II))
SHAKHIDZHANOV, S. S., Phase conditions with buildup of accelerated-particle fluxes, 16: 24874
SHALEK, P. D., Fabrication and properties of US and ThS bodies, 16: 24631
SHANKLAND, Donn Gene, Gauge invariance, 16: 24923
SHAPAR', A. V., Fast neutron capture cross section of Cr, 16: 24810
SHAPIRO, Anatole M., Prog. rpt. on high-energy physics, 16: 23850 (TID-16074)
SHAPIRO, J. L., Reactivity monitor for reactor startup, 16: 24546
SHARP, David H., Three-dimensional geometry, 16: 24326
SHARP, J. C., Effects of fetal x irradiation in cerebral cortex, 16: 23473
SHARP, R. E., Irradiation testing of Pu fuel element at Hanford, 16: 24608
SHARPE, J., Photomultiplier tubes and image intensifiers, 16: 23885
SHARPE, R. S., Use of CCl_4 as radiopaque penetrant, 16: 23978
SHATFORD, P. A., Design of shock tube, 16: 24275 (CLM-R-18)
SHCHEMELEV, V. N., Photoeffect from photocathodes under x rays, 16: 24328
SHEAR, D. D., Shock waves from exploding wires, 16: 24273 (BRL-1152)
SHEBANOV, V. A., Pion production in Coulomb nuclear field, 16: 24695 (NP-11757)
SHEINKER, A. P., Carbanionic mechanism of polymerization under γ rays, 16: 23758
SHEINKER, A. P., Mechanism of polymerization by radiation. I., 16: 23781
SHELAEV, I. A., Electron load of cyclotron resonator, 16: 24867 (JINR-P-962)
SHER, R., Adjusted values of cross sections of U-233, U-235, and Pu-239, 16: 24383
SHERER, D. B., Excursion shutdown mechanism, 16: 24518
SHERMAN, I. S., Response of NaI(Tl) to radiation, 16: 23879
SHERRARD, Herrick, Spark chamber for electronic data retrieval, 16: 23909
SHEWCHUCK, Sergey, Angular distribution of protons, 16: 24800 (UCRL-Trans-828(L))
SHEWCHUCK, Sergey, Wave equation for non-uniform medium, 16: 24917 (UCRL-Trans-796(L))
SHIBATA, Hiromu, Survival of bacteria irradiated with γ rays. I., 16: 23457
SHIEH, S. Y., Pionic decays of Σ hyperons, 16: 24675 (AFOSR-2637)
SHIELDS, R. P., In-pile melting of UO_2 fuel, 16: 24615
SHILLIDAY, T. S., Radiation damage in compound semiconductors, 16: 24234 (ARL-62-343)
SHIMAZAKI, T. T., Effect of reactor core length, 16: 24946 (NAA-SR-Memo-4325(Rev.1))

SHIOHARA, U., Effects of irradiation on polyethylene, 16: 24248
SHIPMAN, J. J., Reaction of polyisoprene and polybutadiene with S, 16: 23538
SHIRAISHI, H., Research on sand drift, 16: 24003
SHIROKOV, M. I., Newton-Wigner coordinate for scalar particle, 16: 24686 (JINR-P-939)
SHIRVAIKAR, V. V., Calibration of GM counters for Ra, 16: 23633 (AEET/AM/24)
SHMELEVA, N. I., Homopoietic system reactions following irradiation, 16: 23445
SHOBER, F. R., Irradiation-induced property changes in Ta, 16: 24639
SHOLETTE, William Paul, Collisions of He atoms in gases, 16: 24296
SHOOBINA, A. W., Influence of drugs upon blood serum toxicity acquired under radiation, 16: 23440
SHOOK, Donald, Neutrons from Be(α,n) sources and Be(n,2n) reactions, 16: 24388
SHOTKIN, Louis, Instabilities in reflected slab reactor, 16: 24524
SHREVE, J. D., Jr., Laboratory vs field exposures to PuO, 16: 23381 (TID-7616(p.127-32))
SHUFLER, S. L., Comparison of self-adjoint variational method, 16: 24368
SHUGUROV, V. K., Spin-orbital interactions, 16: 24829
SHUKLA, B. M., Isotope effect of Br recoil atoms in (n,γ) process, 16: 23723 (AEC-tr-5151)
SHUMAN, R. W., Ytterbium-169 for industrial radiography, 16: 24584
SHURE, K., Evaluation of N-16 specific activity, 16: 24590
SHURE, K., Penetration of point monodirectional γ rays, 16: 24601
SHURE, K., Penetration of γ rays through slab shields, 16: 24907 (WAPD-T-1464)
SILAR, Josef, Scintillation detectors and their applications, 16: 23942
SILNA, M., Postirradiation changes in microsomal lipoprotein, 16: 23450
SILIN, I. N., Phase analysis of nucleon-nucleon scattering, 16: 24687 (JINR-P-944)
SILIN, I. N., Phase analysis of nucleon-nucleon scattering, 16: 24692 (JINR-P-970)
SILL, Claude W., Determination of Ra-226 and Th-230, 16: 23383 (TID-7616(p.147-75))
SILVESTER, A., Conceptual design of Mixed Spectrum Superheater, 16: 24473
SIL'VESTROV, L. V., On charge exchange of π⁻ mesons, 16: 24685 (JINR-P-928)
SIMARD, R., Refining of U, 16: 23774 (NP-11877)
SIMONOV, Yu. N., On n-p scattering of 200-Mev neutrons, 16: 24684 (JINR-P-920)
SIMONS, Eric L., Immunologic unresponsiveness during secondary disease of irradiated mice, 16: 23521
SIMON, H., Isotope effects in labeled compounds, 16: 23577
SIMON, R., Figure of merit of thermoelectrics, 16: 24186
SIMON, Robert H., In-pile loop for HTGR, 16: 24497
SIMONS, Sue, Effects of radiation on neonatal brain, 16: 23477
SIMONSEN, S. H., Crystallographic D-space computer program, 16: 23527 (ANL-6519)
SIMPSON, E., Movement of radioactive substances in ground. II., 16: 25046 (TID-7628(p.155-65))
SIU, F. L., Observations of SL-1 incident effects, 16: 24513
SINCLAIR, W. K., Effect of x radiation on plasma Fe, 16: 23430
SINNO, Kenji, Solar energetic particles, 16: 24305
SIPE, Clyde R., Lymphopenia produced by irradiation, 16: 23434 (BNL-6011)
SIRFSKY, J., Reversal autoradiography, 16: 23669 (NP-11826)
SKAVDAHL, Richard E., Solvent extraction of nitrosylruthenium, 16: 23791 (TID-16139)
SKINNER, A., High speed rotating mirror cameras, 16: 23935
SKOVANEK, Jiri, Temperature dependence of scintillation detectors, 16: 23858 (AEC-tr-5120)
SKY-PECK, Howard H., Incorporation of tritiated thymidine into DNA, 16: 23367
SLAMA, L., Neutron irradiation of chlorobenzene–benzene system, 16: 23719 (AEC-tr-5093)
SLARK, N. A., Transmission secondary emission intensifiers, 16: 23892
SLAWSKY, Milton M., Electric propulsion research, 16: 25030 (AFOSR-1432)
SLIFKIN, Lawrence, Recording heavy primary cosmic radiation, 16: 23931
SLIV, L. A., Gamma rays, 16: 24757
SLOBODRIAN, R. J., Scattering and stripping of deuterons on N, 16: 24831
SLOVOKHOTOVA, N. A., Structure of polyethylene terephthalate, 16: 23746
SLUTSKER, A. I., Disorientation of mosaic blocks by x-ray scattering, 16: 24330
SMALLEY, W., Zircaloy-4 pressure tube for CVTR, 16: 24973 (CVNA-141)
SMETS, Henri B., Liapounoff's functions in reactor dynamics, 16: 24526
SMILEY, J. W., Two-dimensional thermal spectrum calculations, 16: 24367
SMIRENKIN, G. N., Energy of fission products from U-235, 16: 24809
SMIRNOV, A. A., Influence of distortions of lattices of x rays, 16: 24212
SMIRNOV, V. F., Extraction of U and rare earths, 16: 23793
SMITH, A. C. H., Charge transfer in collisions, 16: 24780 (GA-2783)
SMITH, A. M., Bearing materials for EGCR, 16: 24170 (ORNL-TM-249)
SMITH, Basil L., Graone temperature and radiation studies, 16: 23356 (PNE-106F)
SMITH, Dorothy M., Radiosterilization of food and pharmaceuticals, 16: 24052
SMITH, G. G., Effective U-238 resonance capture integrals, 16: 24764 (WAPD-T-1497)
SMITH, G. G., Effective U-238 resonance capture integral of U and UO_2, 16: 24395
SMITH, J. F., Anisotropic thermal expansion of single crystals, 16: 24193 (IS-292)
SMITH, J. F., Calcium, 16: 24114 (IS-223)
SMITH, J. W., Neutron dose in phantom, 16: 23460
SMITH, K. R. E., Shielding calculations for Daphne. I., 16: 25026
SMITH, R. S., Dehydrocyclization of 2,2-dimethyl-4-(methyl-C^{14})-pentane, 16: 23565
SMITH, R. V., Scintillation counters for space radiation, 16: 23927
SMOLIK, Ch. K., Diffusion and thermalization of neutrons in water and ice, 16: 24765 (AEC-tr-5143)
SNIDER, Ray S., Response of nervous system to radiation, 16: 23471
SNOW, W. R., Ion-neutral collisions in afterglow, 16: 24276 (GA-2824)
SNYDER, James, SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)
SOBOLEV, S. L., Wave equation for non-uniform medium, 16: 24917 (UCRL-Trans-796(L))
SOCI, A., Optimum input temperature of reactor coolant, 16: 25005
SOFFA, L. L., Nondestructive testing of hot-pressed Be, 16: 23979
SOKOLOV, V. A., Radiosulfur isotope S-35, 16: 24076
SOKOLOV, V. S., Methods of defectoscopy, 16: 24066
SOKOLOVA, N. V., Relationship of localization of radiation affection to functional state of organ. III., 16: 23436
SOLBERG, H. L., Corrosion effects on heat transfer through tubes, 16: 24127
SOLDAINI, G., Wet steam cooling experiments, 16: 23816 (EURAEC-42)
SOL'TS, V. A., Effect of Re on Co–Cr–Mo–Ni alloy, 16: 24200
SOMOGYI, A., Manufacture of dyeable polytetrafluoroethylene with radiochemical copolymerization, 16: 24207
SOMOGYI, A., Muon component of cosmic radiation, 16: 24670
SOODAK, Harry, Expansion feedback in fast pulsed reactors, 16: 24528
SOSIN, A., Electron damage in Cu, 16: 24260
SOUFFRIAU, J., Movement of radioactive substances in ground. II., 16: 25046 (TID-7628(p.155-65))
SOURANDER, Patrick, Local irradiation of central nervous system with high-energy protons, 16: 23489
SOWBY, F. D., Removal of Am and Pu by chelating agents, 16: 23396
SPALARIS, C. N., Irradiation tests of thin-wall stainless steel clad, UO_2 fuel rods, 16: 24618
SPALARIS, C. N., Materials for nuclear superheat applications, 16: 24155 (GEAP-3875)
SPALARIS, C. N., Uranium dioxide–cladding interactions, 16: 24609
SPALEK, Jan, Single-crystal neutron spectrometer, 16: 24650
SPANO, A. H., Effect of fuel-rod bowing Spert-1, 16: 24535
SPANO, A. H., Measurement of dynamic Doppler coefficient, 16: 24517
SPEES, Steven Tremble, Jr., Photochemistry of complex ions, 16: 23686
SPHAR, C. D., Isotopic composition of irradiated UO_2 fuel rods, 16: 24493
SPIEGLER, P., Production of void and pressure in solution reactor, 16: 24533
SPIERS, F. W., Attenuation factors for tissues exposed to γ radiation, 16: 23459

SPITZER, W. G., Far infrared dielectric dispersion in titanates, 16: 24321
SPOKAS, O. E., Electron resonance magnetometer, 16: 23947
STACEY, M., Synthesis of methyl 3-O-α-d-glucopyranosyl-C^{14}-β-d-xylopyranoside, 16: 23556
STADNIKOVA, T., Neutron cross sections of As, Se, Sb, and Te, 16: 24811
STAFFORD, F. E., Mass spectrometric study of B–C, 16: 24177 (WADD-TR-60-782(Pt.VIII))
STAHL, D., Irradiation-induced property changes in Ta, 16: 24639
STAHL, Walter, Effects of radiation on spinal neurons, 16: 23502
STAHL, Walter R., Research on irradiation injury in U.S.S.R., 16: 23496
STAJANO, A., Antiproton-proton annihilation, 16: 24730
STAMM, Robert F., Polymerization induced by ionizing radiation. I., 16: 23740
STAMM'LER, R. J. J., Computer applied to reactor burnup studies, 16: 24942 (KR-20)
STANDISH, J. W., Mechanical properties of Al alloys, 16: 24171 (R61CAP69)
STANFORD, George S., Foil-data thickness corrections, 16: 24364
STANLEY, J. A., Prog. rpt. on refractory materials, 16: 24178 (WAL-TR-766-3/1-3)
STARIK, I. E., Nuclear geochronology, 16: 24007 (STI/PUB/21/4)
STARK, Yu. S., Work hardening of Cu by nuclear resonance, 16: 24214
STARODUBTSEV, S. V., Radiation-induced changes in salt crystals, 16: 24267
STARR, E., Diffusion parameters of graphite and graphite–Bi, 16: 24375
STAVISSKII, Yu. Ya., Fast neutron capture cross section of Cr, 16: 24810
STEBBINGS, R. F., Charge transfer in collisions, 16: 24780 (GA-2783)
STEBLER, A., Magnetic amplifier in reactor instrumentation, 16: 23861 (CEA-tr-A-1126)
STEEVES, Robert W., Prog. rpt. on thermodynamic properties of Bi-metallic powders, 16: 24139 (AD-269265)
STEFANOVICH, A. N., First voyage of "Lenin" to Arctic, 16: 25009
STEIGER, Naftali H., Adsorption at ionized surface layers, 16: 23585
STEIN, R., Radioactive indicators in chemistry, 16: 23563
STEIN, Ralph P., Temperature transients in fast reactor power excursion, 16: 24501
STEIN, S., Effective U-238 resonance capture integrals, 16: 24764 (WAPD-T-1497)
STEIN, S., Uranium-235 fission-product poison experiments, 16: 24382
STEINBERG, M., Brookhaven chemonuclear in-pile test loop, 16: 24586
STEINBERGER, J., Parity of the neutral pion and decay, 16: 24749
STEPANOV, A. V., Properties of Van Hove pair correlations function, 16: 24766 (AEC-tr-5146)
STEPANOV, S. M., Utilization factor of γ irradiation facilities, 16: 24246
STEPHENSON, L. D., Hazards report for PM-2A Core II, 16: 24966 (APAE-121)
STERMAN, L. S., Parameters for gas-cooled atomic power stations, 16: 25007
STERN, H., Prog. rpt. on fluid transmissions, 16: 23800 (AD-269399)
STERN, H., Submarine power transmissions, 16: 23799 (AD-269398)
STERNGLASS, E. J., Secondary emission for high-speed counting, 16: 23689
STEUNENBERG, R., Sintering of UC from liquid metal media, 16: 24629
STEUNENBERG, R. K., Chlorination of U and fission product oxides, 16: 23663 (ANL-6546)
STEVENSON, J. D., Land burial of radioactive wastes, 16: 25062 (TID-7628(p.396-427))
STEVENSON, John D., Conference on disposal of radioactive wastes, 16: 25037 (TID-7628)
STEVENSON, M. Lynn, Pion-pion interaction, 16: 24750 (UCRL-9814)
STEWART, M. G., Photoproton reaction in Be-9, 16: 24857
STICKLEY, E. E., Human tolerance to thermal neutrons, 16: 23495
STIEGELMEYER, W. L., Corrosion analysis of VPP components, 16: 24118 (BMI-X-201)
STIENNON-BOVY, R., Bibliography on I-132, 16: 23665 (BLG/B-2)
STIENNON-BOVY, R., Bibliography on I-133, 16: 23666 (BLG/B-3)
STIL'BANS, L. S., Scattering by ionic impurities in Bi_2Te_3, 16: 24213
STOCKER, Lajos, Chemical processing of U in Hungary, 16: 23795
STOLARCZYK, Lech, Extraction of U compounds, 16: 23796
STOLARCZYK, Lech, Radical-initiated chain oxidation of Fe(II), 16: 23715 (PAN-285/ChR)
STOLOV, A. M., Design of 7-Bev proton synchrotron, 16: 24872
STOLYAROV, E. D., Radiation analysis methods and devices, 16: 23959
STOLZ, Werner, Measurement of humidity of building materials with γ radiation, 16: 24048
STONE, J. T., Control of boiling water reactor, 16: 24531
STORMS, Howard A., Charge distribution in nuclear fission, 16: 24351
STORRS, C. L., SL-1 recovery operation, 16: 24511
STRANDTMANN, R. W., New species of soil-inhabiting mite, 16: 23363
STRANKS, D. R., Study of halogen atom reactions, 16: 23588
STRANKS, D. R., Tritium-labeled organic compounds, 16: 23589
STRATTON, Kathleen, Therapeutic value of isotopes, 16: 24561
STREHLOW, R. A., Blankets for thermonuclear reactors, 16: 24890 (ORNL-3258)
STREHLOW, R. A., Reactions in molten fluoride media, 16: 23595
STREL'TSOV, N. S., Design of 7-Bev proton synchrotron, 16: 24872
STREL'TSOV, V. N., On charge exchange of π^- mesons, 16: 24685 (JINR-P-928)
STRICKLAND, G., "Phosfluor" process for reprocessing ceramic fuels, 16: 24645
STROMBERG, A. G., Reactions of Ti(IV)–Ti(III) complexes, 16: 23696
STROMINGER, D., Solid state fission counters, 16: 24553
STROUD, D. B. E., Synthesis of methyl 3-O-α-d-glucopyranosyl-C^{14}-β-d-xylopyranoside, 16: 23556
STRUXNESS, E. G., Storage of high-level packaged solid wastes, 16: 25068 (TID-7628(p.477-90))
STUKANOVSKAYA, N. A., Kinetics of $SO_2 + 0.5\ O_2 \rightleftarrows SO_3$, 16: 23584
STURROCK, P. A., Electrodynamic problems of astrophysics, 16: 24656 (ML-879)
SUDA, N., Startup transients in boiling water reactors, 16: 24530
SUIT, Herman D., Oxygen effect factor of human skin, 16: 23466
SULLIVAN, R. P., Fast neutron cross sections, 16: 24796 (UNC-5002)
SUMI, Tetsuo, Applications of γ level gages, 16: 23810
SUN, C. R., Gold-doped Si detectors, 16: 23905
SUND, R. E., Decay of Nb-94 and Nb-94m, 16: 24837
SUNDARAM, S., Spectra of partially deuterated and tritiated stibines, 16: 23705
SUNDERMAN, D. N., Calibration of isotopic neutron source, 16: 24570
SUNDERMAN, D. N., Effect of burnup on Darex and Sulfex head-end processes, 16: 24644
SUNDERMAN, D. N., Measurement of short-lived fission gases, 16: 24563
SUNDERMAN, D. N., Xenon release from recoil-damaged Al_2O_3, 16: 24619
SUNDERMAN, Duane N., Radiochemical separation of short-lived fission products, 16: 24564
SUNDSTROEM, T., Decay of Hf-175, 16: 24806
SUSCHKE, E., Apparatus for γ activity comparison with ionization chambers, 16: 23866
SUSCILLON, M., Action of x-rays on plasma proteins, 16: 23412 (CEA-2132)
SVASEK, A. J., Critical experiments on PWR core mockups, 16: 24413
SWARUP, S., Study on Fe turnovers, 16: 23391
SWEENEY, R., Soil moisture and density by nuclear methods, 16: 23982 (AERE-Bib-140)
SWENSON, Robert James, Determination of transport coefficients, 16: 24921
SWIATECKI, W. J., Deformation energy of a charged drop. IV., 16: 24803
SWIERZAWSKI, T. J., Heat transfer of irradiated Santowax OMP, 16: 24456
SWJAGINZEWA, E. N., Isotopic analysis of waters, 16: 23661
SYBESMA, Christiaan, Energy distribution of γ rays, 16: 24693 (NP-11538)
SYCHEV, B. S., Attenuation of neutrons in concrete, 16: 24908
SYKES, J. B., Spatial kinetics of reactors, 16: 25004 (AERE-Trans-888)
SYRKIN, Ya. K., Combined effect of radiation and catalyst, 16: 23724 (AEC-tr-5153)
SZABO, Elek, Chemical processing of U in Hungary, 16: 23795

T

TABATA, Yoneho, Radiation effects on high polymers, 16: 23752
TABLER, L. Earl, Jr., Internal shielding at Shippingport nuclear power plant, 16: 24232
TACHIS, A., Bench loop for study of pre-irradiated samples, 16: 24106 (EURAEC-57(App.9))
TAEBEL, W. A., Analysis of dense BeO, 16: 23624 (TID-7629(p.135-41))

TAKABAYASI, T., Structure of strong interactions, 16: 24726
TAKEDA, A., Spatial kinetics of reactors, 16: 25004 (AERE-Trans-888)
TAKHAR, P. S., Resolution in sciatillation counters, 16: 23881
TALLINI, B., Meson production in H, 16: 24719
TAL'ROZE, V. L., Reactions of positive ions with molecules in gas phase, 16: 23725 (AEC-tr-5155)
TAMBA, Yoshio, Radiation effects on high polymers, 16: 23752
TAMURA, T., Strontium reactions with minerals, 16: 25049 (TID-7628 (p.187-97))
TANDON, J. N., Cosmic ray increases, 16: 24666
T'ANG, Hsiao-en, Reduction of Pm, 16: 23578
TARASOV, E. K., Design of 7-Bev proton synchrotron, 16: 24872
TARASOV, L. K., Interactions of gaseous $ZrCl_4$, $HfCl_4$, $NbCl_5$ and $TaCl_5$, 16: 23709 (JINR-P-957)
TARASOV, L. V., Spectrum for thermal oscillations of crystals, 16: 24767 (AEC-tr-5156)
TARDIFF, A. Nelson, Aspects of WTR and SL-1 accidents, 16: 25021 (IDO-19308)
TARQUINI, A., Human pulmonary circulation, 16: 23395
TASSELLI, R., Television camera for Ispra-1 control room, 16: 25015 (CNEN-134)
TAUBE, M., Molten Pu and U chlorides as reactor fuels, 16: 25002 (AEC-tr-5161)
TAYLOR, D. M., Removal of Am and Pu by chelating agents, 16: 23396
TAYLOR, J. C., Singularities of scattering amplitudes, 16: 24732
TAYLOR, R. E., Thermal conductivity of ZrC, 16: 24192
TCHEN, C. M., Interaction of plasma stream with geomagnetic fields, 16: 24657 (R62SD30)
TEIKHMAN, Yu., Accelerators with vertically increasing field, 16: 24873
TEITELBAUM, P., Statistical distribution of stochastic fields, 16: 24882 (ARL-250)
TELBISZ, F., Muon component of cosmic radiation, 16: 24670
TELESHOV, E. N., Radiolysis of polymers, 16: 23745
TEMNIKOVA, N. I., Radioisotope I-131, 16: 24075
TEMPELMEYER, K. E., Gas dynamics of Ar plasma, 16: 24879 (AEDC-TDR-62-88)
TENENBAUM, I. M., Errors in γ assaying, 16: 23992
TERENT'EV, V. G., Protection systems for reactors, 16: 24954
TER-MARTIROSYAN, K. A., Nuclear reactions, 16: 24799 (AEC-tr-5160)
THADDEUS, P., Level crossing in $(5s5p)\ ^3P_1$ state of Cd-111 and Cd-113, 16: 24850
THAKORE, Suresh, Monte-Carlo calculation of a nuclear cascade, 16: 24697 (NYO-10132)
THEIS, C. V., Dispersion in fluid flow by geologic features, 16: 25047 (TID-7628(p.166-78))
THEWS, R., Investigation of subcritical assemblies by pulsed neutron source tchnique, 16: 24424
THEXTON, H. E., Radiation of SAP-clad UO_2 fuel, 16: 24458
THIBAULT, M., Separation of Zr and Hf, 16: 23792 (AEC-tr-5099)
THIRRING, W. E., Models for compound particles, 16: 24722
THOMAS, D. H., Analytic approach to two-dimensional reactor theory, 16: 24399
THOMAS, Daniel J., Dieldrin labeled with C-14, 16: 23554
THOMAS, G., Aluminum alloy electron transmission, 16: 24194 (UCRL-9562)
THOMAS, Henry C., Sorption on clay minerals, 16: 25048 (TID-7628 (p.179-86))
THOMAS, R. G., Movement of Pu through LA tuff, 16: 25054 (TID-7628 (p.248-81))
THOMAS, Robert G., Antimony-124 chloride in rat following inhalation, 16: 23386 (UR-608)
THOMAS, T. Darrah, Spallation-fission competition in At, 16: 24854
THOMPSON, C. W., Large area liquid scintillation and Cherenkov counters, 16: 23937
THOMPSON, John S., Immunologic unresponsiveness during secondary disease of irradiated mice, 16: 23521
THOMPSON, R. L., Bibliosbstract on radiation effects, 16: 24233 (57GL77)
THOMPSON, T. J., Flux distribution in cavity assembly, 16: 24428
THOMPSON, T. J., Flux distributions in U–D_2O lattices, 16: 24430
THOMPSON, T. J., Measurements of U-238 capture and fast fission, 16: 24429
THOMPSON, T. J., Operating costs of MIT Reactor, 16: 24491
THOMPSON, T. J., Reactivity behavior of Yankee Core I, 16: 24472
THOMPSON, Theos J., Measurement of neutron energy spectra with MIT fast chopper, 16: 24369
THOMPSON, W. E., Angular distribution of dose rate due to γ rays, 16: 24600
THOMPSON, W. E., Dose from γ rays scattered through Fe and Al, 16: 24906 (USNRDL-TR-558)
THORBURN, G. D., Myocardial blood flow determined with Kr-85, 16: 23362
THORP, A. G., II, Significant parameters in DNB, 16: 24507
TICKNOR, L. B., Liquid metal solution calorimeter, 16: 23949
TIKHOMIROVA, E. A., Radiosulfur isotope S-35, 16: 24076
TIKHOMIROVA, N. S., Diffusion processes in several polymers. III., 16: 24268
TIKHONOVA, E. A., Influence of distortions of lattices of x rays, 16: 24212
TILLAEV, R. S., Radiation copolymerization of acrylonitrile, 16: 23541
TIMEROV, R. Kh., Spin-lattice relaxation time in supercooled solutions of Ti^{3+}, 16: 23703
TIMNAT, Y., Condensation behind normal shocks, 16: 24889 (NP-11601)
TINLOT, J., Monte-Carlo calculation of a nuclear cascade, 16: 24697 (NYO-10132)
TISHIN, V. G., Electron load of cyclotron resonator, 16: 24867 (JINR-P-962)
TISSIER, J. M., Nuclear electronics, 16: 23943
TITTLE, C. W., Perturbation of foil activation in neutron fields, 16: 24363
TITUS, G. W., High-temperature irradiation of UO_2–BeO bodies, 16: 24623
TITUS, G. W., Oxidation of UO_2 and BeO–UO_2 fuel pellets, 16: 24622
TOBIAS, C. A., Fluorescein as indicator of radiation injury to brain, 16: 23491
TOBIAS, Cornelius, Changes in brain caused by α particles, 16: 23492
TOBIAS, Cornelius A., Lesions with accelerated particles, 16: 23488
TODOROV, I. T., Surface of special points of Feynman's diagram, 16: 24683 (JINR-P-889)
TOEROEK, Gabor, Insect control by radiation, 16: 24053
TOLGYESSY, J., Application of β backscattering for control of ointments and pastes, 16: 24065
TOMASHEV, N. D., Corrosion and protection of construction materials, 16: 24129
TOMCZAK, Zenon, Thermal and fast neutron flux in EWA, 16: 25027
TONG, L. S., Significant parameters in DNB, 16: 24507
TOPCHIEV, A. V., Polymerization of allylsilanes, 16: 23747
TOPPEL, B. J., CYCLE and COST—codes for fast reactor fuel cycle analysis, 16: 24437
TOPPEL, B. J., Fuel cycle studies, 16: 24484
TOROPOVA, M. A., Isotope effects in β decay of Pb isotopes, 16: 23722 (AEC-tr-5150)
TOTH, Bela, Production of carrier-free radioisotopes. VI., 16: 24084
TOTH, Geza, Production of carrier-free radioisotopes. VII., 16: 24085
TOVPENETS, E. S., Effect of cooling on austenite, 16: 24197
TOWNLEY, C. W., Measurement of short-lived fission gases, 16: 24563
TOWNLEY, Charles W., Radiochemical separation of short-lived fission products, 16: 24564
TRALLI, N., Fast neutron cross sections, 16: 24796 (UNC-5002)
TRASK, W. T., Production of UO_2, 16: 23773 (MCW-1470)
TREADO, F. A., Gamma spectra of W isotopes, 16: 24840
TRE[illegible]S, M. A., Alkaline earth determinations, 16: 23601 (HW-69677)
TREMILLON, Bernard, Separation of Zr and Hf, 16: 23792 (AEC-tr-5099)
TREMILLON, Bernard, Separation of metallic elements by anion exchange resins. II., 16: 23673 (AEC-tr-5098)
TRIBBLE, J. E., Yankee fuel cycle development, 16: 24468
TRIER, A., Neutrons reactions (n,p) and (n,γ), 16: 24787 (NP-11793)
TRIMBLE, G. D., Low-energy neutron spectra in D_2O and H_2O, 16: 24366
TRIPLETT, J. R., French and British methods in reactor theory, 16: 24938 (HW-71649)
TRLIFAJ, L., Two-group boundary conditions in square lattices, 16: 24772
TROFIMOV, A. S., Thermal conductivity of multilayer element, 16: 23829
TROMP, R. L., Uranium-235 mass yields below 0.5 ev, 16: 24349
TROOST, M., Neutron streaming in HTGR, 16: 24596
TROUBETZKOY, E. S., Fast neutron cross sections, 16: 24796 (UNC-5002)
TROUVE, J., Prog. rpt. on C–U–Th system, 16: 24179 (AEC-tr-5174)

TRUEMPER, J., Outer surface contamination of jet planes, 16: 24022
TRUNOVA, N. M., Electric reaction of retina in action of γ rays, 16: 23437
TRUPIN, B. H., Fast neutron cross sections, 16: 24796 (UNC-5002)
TSUDA, Yoshizo, Radiation-induced polymerization, 16: 23739
TSUNEKAWA, Yoshinori, Effects of γ radiation on polyethylene, 16: 24259
TSYPIN, A. B., Electric reaction of retina in action of γ rays, 16: 23437
TUBIANA, M., Radiation effects on thyroid function, 16: 23431
TUCKER, W., Brookhaven chemonuclear in-pile test loop, 16: 24586
TUHKOV, V. P., Non-aging low-carbon steel, 16: 24198
TUPITSYN, I. F., Isotope effect in H exchange reactions, 16: 23569
TUPMAN, L. M., Startup instrumentation, 16: 24974 (DC-55-7-61)
TURCHIN, V. F., Scattering of neutrons in liquids, 16: 24768 (AEC-tr-5158)
TURCO, G. L., Human pulmonary circulation, 16: 23395
TURKEVICH, John, Solubility of $SrSO_4$, 16: 23592
TURLAY, Rene, Study of $\pi^- + p \rightarrow \pi^0 + n$ and $\pi^- + p \rightarrow \pi^0 + \pi^0 + n$ reactions, 16: 24677 (CEA-2136)
TURNER, Charles William, Electron bunching in angle cavities, 16: 24299
TURRICCHIA, A., In-pile irradiation of Santowax OMP, 16: 24455
TURRIN, A., Preventing resonance discharge in cavity resonator, 16: 24869 (AERE-Trans-890)
TURSKA, E., Peroxides of polymethyl methacrylate, 16: 23743
TUSTING, Robert F., Photomultiplier single-electron statistics, 16: 23893
TUTROSKII, I. A., Transformation of rubbers under γ radiation, 16: 23543
TUTTLE, R. J., Neutron importance in mixed-spectra critical assemblies, 16: 24418
TYLKINA, M. A., Effect of Re on Co–Cr–Mo–Ni alloy, 16: 24200

U

UEBERALL, H., Polarization of quasi-monochromatic bremsstrahlung, 16: 24756
UFIMTSEV, B. F., Mutual solubility of metals, 16: 24181 (AEC-tr-5177)
UHLER, J., Mass number assignments and γ spectra of Sn and Sb isotopes, 16: 24805
Ui, Haruo, Heavy-particle-stripping reaction. I., 16: 24838
Ui, Haruo, Heavy-particle-stripping reaction. II., 16: 24839
UKAJI, Rokuo, Reactivity of U_3O_8. I., 16: 23776 (AEC-tr-4939)
ULYANOV, M. I., Leukocytic reactions following x irradiation, 16: 23446
UMINSKI, Tadeusz, Influence of γ radiation and neutrons on lacquer coatings, 16: 24263
UPSON, U. L., In-cell γ analyzer, 16: 23618 (TID-7629(p.42-53))
URODE, R. J., Prog. rpt. on refractory materials, 16: 24178 (WAL-TR-766-3/1-3)
UROSEVIC, V., What isotopes offer us, 16: 24074
USENIK, Edward A., Lymphopenia produced by irradiation, 16: 23434 (BNL-6011)
USMANOV, Kh. U., Modification of cellulose by grafting, 16: 23544
USMANOV, Kh. U., Radiation copolymerization of acrylonitrile, 16: 23541
UTSUMI, Tadashi, Primary radicals in vinyl polymerization, 16: 23738

V

VALCKX, F. P. G., Scattering of pions on C and O, 16: 24720
VALE, R. L., Radiation vulcanization of hydrocarbon polymers, 16: 24254
VALLAURI, M. E., Vapor pressure of isotopic solids, 16: 24311
VAN ANTWERP, W. R., Initial γ spectrograph, 16: 23844 (NDL-TR-20)
VAN DER GRINTEN, W. J., Thermocouple energy converters, 16: 23831 (AD-269034)
VAN DILLA, M. A., Lunar composition by scintillation spectroscopy, 16: 23930
VAN DYKE, D. C., Fluorescein as indicator of radiation injury to brain, 16: 23491
VAN-HIEW, Nguyen, Elastic neutrino and antineutrino scattering, 16: 24688 (JINR-P-947)
VAN LEEMPUT, R., Radioactive indicators in chemistry, 16: 23563
VAN LINT, V. A. J., Ion-neutral collisions in afterglow, 16: 24276 (GA-2824)
VAN MULDERS, E., Flow tests of BR-2 fuel elements, 16: 24985 (NDA-2561-1)
VAN NORTON, R., Computational problems of plasma physics, 16: 24443
VAN THYNE, R. J., Prog. rpt. on Fe–Cr–Al alloys, 16: 24156 (GV-298)
VANYUKOV, M. P., Spark discharge in atmospheres of Ar and Xe, 16: 24289 (NP-tr-898)
VARGOFCAK, D., ULCER and QUICKIE—diffusion theory programs, 16: 24436
VARSAVSKY, Carlos M., Prog. rpt. on spectrum of ionized O, 16: 24088 (TID-16127)
VASIL'EV, A. A., Design of 7-Bev proton synchrotron, 16: 24872
VATSEK, A., Metabolic reactivity of irradiated organism, 16: 23422 (AEC-tr-5190)
VAUGHAN, D. E., Irradiation of alloy junction transistors, 16: 24252
VEDRENNE, G., Reaction $Si^{28}(n,\alpha)Mg^{25}$, 16: 24846
VENER, H., Prog. rpt. on PM-1 nuclear power plant, 16: 24983 (MND-M-1866)
VENTERS, Lydia, Initial mechanisms of biological effects of radiation, 16: 23423 (AEC-tr-5215)
VEOMETT, Robert C., Radiation breakage of chromosomes, 16: 23465
VERBINSKI, V. V., Low-energy neutron spectra in Li hydride, 16: 24592
VERHAEGEN, G., Mass spectrometric study of B–C, 16: 24177 (WADD-TR-60-782(Pt.VIII))
VERSLUYS, Willem, Prog. rpt. on thermodynamic properties of Bi-metallic powders, 16: 24139 (AD-269265)
VERYATIN, U. D., Reduction of U oxides and UO_2F_2, 16: 24187
VESELA, Mario, Temperature dependence of scintillation detectors, 16: 23858 (AEC-tr-5120)
VIANO, G., Three-body Green's function for S-states, 16: 24733
VIDEM, Kotil, Corrosion of Al in contact with stainless steel, 16: 24121 (KR-18)
VIGIER, J. P., Mass of Yang-Mills vector field, 16: 24729
VIGVARI, Mihaly, Chemical processing of U in Hungary, 16: 23795
VINCENT, C. H., Fast pulse multiplication, 16: 23917
VINCIGUERRA, D., Nuclear reaction cross sections, 16: 24845
VINOKUROVA, F. A., Determination of Nb, 16: 23659
VIRKKUNEN, V-E. J., Strontium-90 in reindeer bone, 16: 23402
VISCO, Sabato, Use of radiating energies for preservation of foods, 16: 24039
VLADIMIRSKII, V. V., Design of 7-Bev proton synchrotron, 16: 24872
VODOP'YANOV, F. A., Design of 7-Bev proton synchrotron, 16: 24872
VODOP'YANOV, L. K., Electrical conductivity of titanates subjected to radiation, 16: 24266
VOEDROES, Daniel, Current efficiency in aluminum furnaces, 16: 23812
VOGEL, F. Stephen, Effects of γ radiation on brain, 16: 23484
VOGEL, Howard H., Fertility of mice irradiated with neutrons, 16: 23467
VOGT, J. W., Thermal properties of LiH and LiH–Li mixtures, 16: 23670 (NP-11888)
VOIGT, A. F., Solubility of metallic Hg, 16: 23591
VOLKOFF, J. J., Nuclear-electric spacecraft, 16: 25031 (JPL-TR-32-232)
VOLKOV, Yu. M., Photonuclear reactions with deuteron emission, 16: 24835
VON DER DECKEN, C. B., Investigations of fuel elements in hot loop, 16: 24184 (AEC-tr-5213)
VON SALLMANN, Ludwig, Effect of deuteron microbeam on mouse lung, 16: 23428 (BNL-6081)
VOROB'EV, A. A., Mutual solubility of metals, 16: 24181 (AEC-tr-5177)
VOROB'EV, E. I., Protection against x and γ rays, 16: 24034
VOROSHILOV, M. S., Automation in pulp and paper industry, 16: 24077
VORSPRACH, F., Agfa-Texo-F film in testing with γ rays, 16: 23977
VORTMAN, L. J., Atomic explosion effects on shelters, 16: 24018 (WT-1161)
VOSHAGE, H., Intensity variations of cosmic radiation during last million years, 16: 24672
VUORINEN, A. P. U., Strontium-90 in reindeer bone, 16: 23402

W

WACHTMAN, J. B., Jr., Thermal expansion of Al_2O_3 and ThO_2, 16: 24190
WAENKE, H., Primordial rare gases in meteorite Breitscheid, 16: 23998
WAGNER, Henry N., Measurement of Hg-203 chlormerodrin accumulation by kidneys, 16: 23400
WAGNER, S., Silicon surface barrier particle detectors, 16: 23830 (BNL-737)
WAHL, R., Nuclear electronics, 16: 23943

WAHL, Reinhold, Radioactive luminous paints, 16: 24055
WAHL, Reinhold, Radioactive luminous paints, 16: 24056
WADE, C., Brookhaven chemonuclear in-pile test loop, 16: 24586
WADELICH, Wilhelm, Color center formation in irradiated LiF, 16: 23766
WAHERDI, R. E., Computer-coupled, automatic activation analysis, 16: 23632 (TID-7629(p.221-38))
WAKEFIELD, Gene Felix, Vapor pressure of Ho, 16: 24188
WAKEMAN, J. F., Instrument for monitoring air-borne Be, 16: 24571
WALKER, James H., Radioactive gas in detection cardiac shunts, 16: 23368
WALKER, W. H., Fission product poisoning from fission of U-238, 16: 24779 (CRRP-1090)
WALKER, W. L., Inhibition of corrosion of stainless steel in HNO_3–HF mixtures, 16: 24120 (HW-73211)
WALL, L.A., Gamma irradiation of fluorocarbon polymers, 16: 23707 (AFL-62-350)
WALLACE, C. G., Isolation of micro quantities of U, 16: 23596 (AERE-R-3499)
WALLACE, W. E., Prog. rpt. on alloy formation, 16: 24173 (TID-15819)
WALTER, H., Particle discrimination with KI(Tl) scintillators, 16: 23956
WALTERS, William LeRoy, Gamma from Al bombarded by protons and H_2^+ ions, 16: 24824
WALTHOUSEN, L. D., Critical experiments on PWR core mockups, 16: 24413
WALTON, Alan, Nuclear debris in precipitation, 16: 23985 (NYO-9532)
WALTON, J. D., Prog. rpt. on high temperature ceramics, 16: 24132 (NP-11713)
WALY, Adnan, Radiation detectors, 16: 23960
WANG, L., Properties of n^+-i-p^+ semiconductor detector, 16: 23896
WARBURTON, E. K., Gamma rays from B-10, 16: 24830
WARD, W. T., Reactions in molten fluoride media, 16: 23595
WARKE, W. R., Decarburization effects on steels, 16: 24152 (DMIC-Memo-154)
WARREN, F. L., Astronautics information, Vol. V, No. 4, 16: 25032 (NP-11619)
WARREN, Ian Harry, Production of UO_2, 16: 23777
WARREN, Roger W., Ratio of diffusion coefficient to mobility coefficient for electrons, 16: 24281 (NP-11846)
WARREN, Shields, Biological and medical effects of radiation, 16: 23418 (TID-16219)
WARREN, Shields, Biological and medical effects of radiation, 16: 24556
WARSCHAWSKI, Ju. M., Isotopic analysis of waters, 16: 23661
WASIL, B. A., Heavy steel–aggregate concrete, 16: 24228
WASSERMAN, Arthur A., High-power reactor describing function, 16: 24527
WATANABE, Masamoto, Polymerization of acrylonitrile in aqueous solution, 16: 23737
WATANABE, Wataru, Effect of γ rays on food microorganisms. VIII., 16: 23425
WATANABE, Wataru, Effect of γ rays on food microorganisms. IX., 16: 23426
WATERBURY, G. R., Determination of W in Ta, 16: 23619 (TID-7629(p.55-61))
WATERBURY, G. R., Determination of Mo and W in Pu, 16: 23620 (TID-7629(p.62-6))
WATERS, D. G., Angular distributions in $N^{14}(d,p)N^{15}$, 16: 24841
WATERS, J. R., Observing photoelectrons in image intensifiers, 16: 23906
WATLING, J., Determination of As in steels, 16: 23597 (AERE-R-3974)
WATSON, Edward, Nuclear magnetic resonance detectors, 16: 23962
WATSON, G. M., Corrosion by molten fluorides, 16: 23594
WATSON, G. M., Reactions in molten fluoride media, 16: 23595
WATSON, M. T., Zirconium oxide and boron–silicon refractories, 16: 23599 (ARL-180)
WATTS, H. V., Neutron imaging, 16: 23966 (ANL-6515(p.53-80))
WEAVER, Boyd, Separation of transuranium elements from rare earths, 16: 24344
WEBB, B. A., Irradiation behavior of U–C fuels, 16: 24611
WEBB, M. S. W., Barium in bones and foodstuffs, 16: 23370 (AERE-R-4025)
WEBB, P. P., Window thickness of diffused junction detectors, 16: 23897
WEBER, J., Investigation of subcritical assemblies by pulsed neutron source technique, 16: 24424
WEBSTER, W., Yankee summary and evaluation, 16: 24466
WECHSELBERGER, F., Radiation damage in iron and steel industry, 16: 24031
WEED, R., Interaction of Hg with erythrocytes, 16: 23393
WEED, Ronald D., Decontamination of PWR systems, 16: 24939 (HW-SA-2548)
WEEKS, J. R., Liquid metal fuel constitutions. III., 16: 24216
WEGNER, H. E., Energetics of fission reactions, 16: 24350
WEHE, D. J., Fortran program for single crystal absorption corrections, 16: 24095 (ORNL-TM-229)
WEIDENMULLER, H. A., Angular distribution of protons, 16: 24800 (UCRL-Trans-828(L))
WEIHS, Annelies, Modification of fibers by radiation. I., 16: 24249
WEIHS, Annelies, Modification of fibers by radiation. II., 16: 24250
WEILER, M. R., Alkaline earth determinations, 16: 23601 (HW-69677)
WEIMER, K. E., Broadening of He^+ 4686 line in ion temperature measurements, 16: 24283 (NYO-7885)
WEINBERG, A. F., Prog. rpt. on carbides for thermionic space reactors, 16: 24154 (GA-3245)
WEINREICH, Marcel I., Rotating coil indicators, 16: 23862 (SCL-T-419)
WEINSTEIN, D., Prog. rpt. on Zr alloys, 16: 24117 (ARF-2198-28)
WEINSTOCK, Jacques J., Prog. rpt. on large fission product β sources, 16: 24696 (RAI-201)
WEISE, L., Radiation measuring technique, 16: 23872
WEISE, L., Radiation measuring technique, 16: 23873
WEITZBERG, A., Measurements of U-238 capture and fast fission, 16: 24429
WELLNER, M., Iteration method for connected graphs, 16: 24847
WELLS, Ronald L., Oxidation resistance of NbAl$_3$, 16: 24174 (TID-16032)
WENSTRUP, F. D., Reactor analysis program for IBM-704, 16: 24935 (DC-61-2-97)
WENZ, D. A., Chlorination of U and fission product oxides, 16: 23663 (ANL-6546)
WEST, G. B., TRIGA shutdown mechanism, 16: 24520
WESTERMARK, T., Labeling of organic compounds, 16: 23551
WETHINGTON, J. A., Jr., Separation of γ pulses from neutron pulses in NaI(Tl) detectors, 16: 24579
WHEELER, John A., Three-dimensional geometry, 16: 24326
WHETSTONE, Albert L., Survey of nanosecond techniques, 16: 23912
WHITE, C. S., Blast effects in shelters on animals and dummies, 16: 24017 (WT-798)
WHITE, E., Outside test tank activation tape data, 16: 24904 (DC-61-2-98)
WHITE, G. D., Sintering of UC from liquid metal media, 16: 24629
WHITENER, E. M., Dissolution of nuclear fuels. III., 16: 23783 (IDO-14584)
WHITNEY, C. L., Cyclic pressure tests of pressure vessels, 16: 23807 (TID-15979)
WHOLEY, Mark H., Radioactive gas in detection cardiac shunts, 16: 23368
WIECZORKOWSKI, E. A., Control rod withdrawal transients for PWR, 16: 25000 (WAPD-PWR-TE-99)
WIEDENBECK, M. L., Decay of Nb-94 and Nb-94m, 16: 24837
WIESENACK, G., Radioactivity in dust and rain, 16: 24006
WIKNER, N. F., Nuclear data for GAM-I data tape, 16: 24088 (GA-2451 (Vol.II))
WIKNER, N. F., Reactor shutdown mechanisms in Peach Bottom HTGR, 16: 24519
WILCOX, David Lovern, Dielectric behavior in $PbHfO_3$–$BaHfO_3$, 16: 23688
WILCOX, Ralph Myron, Calculating Dirac traces, 16: 24922
WILDER, A. B., Evaluation of superheater tube alloys, 16: 24126
WILEY, W. C., Electron multipliers utilizing continuous strip surfaces, 16: 23890
WILHELMSSON, K. H. B., Interaction between EM wave and electron beam, 16: 24308
WILKINS, J. Ernest, Jr., Heat conduction in one-dimensional geometry, 16: 24500
WILKINS, Mark L., Shock hydrodynamics, 16: 24286 (UCRL-6797)
WILKINSON, M. K., Magnetic structures of Tm, 16: 24204
WILLEY, Raymond Starr, Theoretical models of atomic nuclei, 16: 24825
WILLIAMS, Evan T., Surface analysis by nuclear particle scattering, 16: 24567
WILLIAMS, R. L., Window thickness of diffused junction detectors, 16: 23897
WILLIAMSEN, N. R., Evaluation of N-16 specific activity, 16: 24590

WILLIAMSEN, H. R., Setting neutron current at boundaries, 16: 24403
WILLIAMSON, H. E., Economic evaluation of control rods, 16: 24485
WILLIAMSON, H. E., Investigation of B_4C–Ni electro dispersions, 16: 24107 (GEAP-3831)
WILLIAMSON, H. E., Irradiation tests of thin-wall stainless steel clad, UO_2 fuel rods, 16: 24618
WILLIGAN, D. A., Stability of vitamin B_{12}–Co^{60} content of liver, 16: 23397 (BNL-4888)
WILLOUGHBY, A. B., Thermal radiation from nuclear detonation, 16: 23854 (WT-543)
WILSON, C. R., Fission gas release from pebble bed reactor fuel elements, 16: 24627
WILSON, John F., Bubbling two-phase mixture, 16: 24510
WILZBACH, K. E., Effect of radiation on toluene, 16: 23586
WILZBACH, K. E., Labeling by electric discharge, 16: 23548
WINCEL, Henryk, Radiation yields in two-phase system of O_2(g)–H_2O, NaOH, Na_2SO_4(1), 16: 23716 (PAN-290/ChR)
WINDERS, G. R., Design of Advanced Test Reactor, 16: 24488
WINEMAN, R. J., Reclamation of organic nuclear reactor coolant, 16: 24462
WING, J. W., Measurements of Cu(p,n) cross sections, 16: 24793 (TID-12696)
WINKLER, R., Peat for purification of radioactive waste, 16: 25078
WINTERS, C. E., High Flux Isotope Reactor, 16: 24341
WITKOWSKI, E. J., Ground disposal of liquid wastes, 16: 25070 (TID-7628 (p.506-12))
WITT, F. J., Effect of seismic vibrations on EGCR, 16: 24986 (ORNL-3224)
WITT, J. R., Preparation of anhydrous lanthanon acetates by desolvation, 16: 23697
WITTE, L. P., Concrete made with barite aggregates, 16: 24229
WITTER, Harry C., Concrete made with Fe aggregate, 16: 24226
WOLBERG, J. R., Measurements of U-238 capture and fast fission, 16: 24429
WOLFARTH, Eugene Fred, Isotope effects on *ortho*-Claisen rearrangement, 16: 23535
WOLFE, B., Analysis of Mixed Spectrum Superheater, 16: 24474
WOLFE, B., Conceptual design of Mixed Spectrum Superheater, 16: 24473
WOLFE, B., Core design for 500-Mwe fast oxide reactor, 16: 24479
WOLFENDALE, A. W., Change ratio of cosmic ray muons, 16: 24669
WOLLAN, E. O., Magnetic structures of Tm, 16: 24204
WONG, David Y., Nucleon-nucleon dispersion relations, 16: 24751
WOOD, A. J., Determination of burnup, 16: 23626 (TID-7629(p.152-65))
WOOD, Robert Winfield, Construction of neutron long counter, 16: 23849 (TID-15746)
WOODMAN, F. J., Determination of Ar in CO_2, 16: 23598 (ARDC/P.36)
WOODSON, C. W., Boiling heat transfer and burnout correlations, 16: 23817 (HW-71684)
WOODWARD, A. E., Studies of irradiated polypropylene, 16: 24253
WOODWARD, T. W., Gamma-radiolysis of gases, 16: 23730
WOODY, R. J., Substitutes for glue in ore treatment, 16: 23769 (ACCO-2)
WOOLGAR, A. J., Transmission secondary emission intensifiers, 16: 23892
WORSECK, Michel, Inactivation of milk microbes with Co radiation, 16: 23455
WOY, E. A., Nitrogen adsorption-desorption measurements, 16: 23641 (TID-7629(p.345-56))
WRIGHT, Robert W., Steam void oscillations under forced flow, 16: 24534
WRIGHT, W. B., Analysis of BeO moderated cores containing H. L., 16: 24411
WRIGHT, W. B., Analysis of BeO moderated cores containing H. II., 16: 24412
WULFF, J., Prog. rpt. on joining refractory metals, 16: 24135 (WAL-460.54/1-1)
WYMAN, Leland C., Prog. rpt. on effects of radiation on adrenocortical tissue, 16: 23417 (TID-16122)

Y

YAKOVLEV, B. M., Design of 7-Bev proton synchrotron, 16: 24872
YAKOVLEV, V. V., Cutaneous vessels in monkeys after radiation sickness, 16: 23518
YAKOVLEVA, L. A., Disturbances in generative system following radiation sickness, 16: 23522
YAKUBOVICH, I. A., Extraction of U and rare earths, 16: 23793
YALCH, J. P., Program for computation of total macroscopic cross section and collision probabilities, 16: 24089 (GEMP-114)
YALCH, J. P., Program for preparation of spectrum tables, 16: 24090 (GEMP-116)
YALCH, J. P., Program for computing nuclear excitation and transition probabilities, 16: 24091 (GEMP-117)
YALCH, J. P., Program for approximating cross section dependence on energy, 16: 24678 (GEMP-113)
YALCH, J. P., Program for averaging differential scattering cross sections, 16: 24679 (GEMP-115)
YAMADA, Kinjiro, Browning of irradiated fish. I., 16: 24071
YAMADA, Kinjiro, Effects of γ irradiation on fish, 16: 24070
YAMAGUCHI, S., Electron diffraction for magnetic analysis, 16: 24211
YAMAMOTO, Y. L., Human tolerance to thermal neutrons, 16: 23495
YAMAZAKI, J. N., Effects of radiation on neonatal brain, 16: 23477
YAMAZAKI, James N., Effects of head irradiation in newborn rats, 16: 23475
YANG, L., Prog. rpt. on carbides for thermionic space reactors, 16: 24154 (GA-3245)
YAO, J. T. P., Fatigue of metals, 16: 24172 (SSC-137)
YARAMIS, Bahriye, Protons from $Al^{27}(\alpha,p)Si^{30}$ reaction, 16: 24828
YAVOR, I. P., Photodisintegration of N, 16: 24834
YAVORSKY, P. M., Prog. rpt. on radioisotopes in coal research, 16: 24035 (NYO-9851)
YEH, C. S., Fission neutron importance in fast reactor spectrum, 16: 24398
YIN, L. I., Decay of Nb-94 and Nb-94m, 16: 24837
YING, Wen-k'ang, Radiolysis of polystyrene, 16: 23546
YOUNG, J. C., Low-energy neutron spectra in D_2O and H_2O, 16: 24366

Z

ZABETAKIS, Michael G., Hazards in use of liquid H in bubble chambers, 16: 24015 (TID-15985)
ZABORENKO, K. B., Separation of natural radioisotopes, 16: 23990 (AEC-tr-5159)
ZACK, J. F., Jr., Coolant decomposition and makeup costs for organic reactors, 16: 24457
ZADUMINSKI, M., Sterilization of drugs by γ rays, 16: 23424
ZAGER, B. A., Electron load of cyclotron resonator, 16: 24867 (JINR-P-962)
ZAGORSKI, Zbigniew P., Radiation yields in two-phase system of O_2(g)–H_2O, NaOH, Na_2SO_4(1), 16: 23716 (PAN-290/ChR)
ZAITSEV, L. N., Attenuation of neutrons in concrete, 16: 24908
ZAITSEV, V. M., Synthesis of organic compounds of Po, 16: 23721 (AEC-tr-5149)
ZANE, Ronald, SMP-1 scanning and measuring projector, 16: 23851 (UCRL-10109)
ZANNONI, G., Capture ratio in Cr-51 decay, 16: 24844
ZASLER, J., In-pile gas-cooled unclad fuel element test facility, 16: 24601
ZASLER, J., In-pile gas-cooled fuel test facility, 16: 24950 (ORNL-TM-250)
ZASTROW, E., Steel for pressure vessels for power reactors, 16: 24215
ZAVATTARELLI, R., Wet steam cooling experiments, 16: 23816 (EURAEC-42)
ZDANIS, R. A., Observing photoelectrons in image intensifiers, 16: 23906
ZEIGLER, R. K., Determination of specific activity of Pu, 16: 23629 (TID-7629(p.185-92))
ZELENY, W. B., Nonleptonic weak interactions, 16: 24741
ZEMAN, Wolfgang, Changes in irradiated nerve cells, 16: 23494
ZETZSCHE, A., E modulus in irradiated Cu, 16: 24261
ZHETVIN, N. P., Non-aging low-carbon steel, 16: 24198
ZHURAVLEV, A. A., Electron acceleration in annular synchrocyclotron, 16: 24866 (JINR-P-914)
ZIEMBA, F. P., Detectors for space spectrometry, 16: 23928
ZIEMBA, F. P., Properties of n^+-i-p^+ semiconductor detector, 16: 23896
ZIJLSTRA, H., Interacting polarized particles, 16: 24745
ZIMMERMAN, D. L., Investigation of B_4C–Ni electro dispersions, 16: 24107 (GEAP-3831)
ZIMMERMAN, J. B., Determination of U, 16: 23604 (NP-11873)
ZIMMERMAN, Walter Bruce, Infrared absorption spectra of isotopically

enriched LiH, 16: 23691
ZIMERMANN, W., Apparatus for γ activity comparison with ionization chambers, 16: 23866
ZOLKOWSKI, J., Structure of complex compounds, 16: 23570
ZVI, S. M., Reactor shutdown mechanism, 16: 24522
16: 24532
ZOLA, P. C., Control and transients of self-pressurized water reactors,
ZOLA, P. C., Superheat cycle for H_2O-moderated and -cooled reactors, 16: 24475
ZOSEL, Walter, Flux depression for Au foils exposed in water, 16: 24361
ZOLOTUKHIN, V. G., Errors in neutron flux level parameters, 16: 24771
ZORN, GUS T., Delay between particle passage and chamber spark, 16: 23910 (BNL-6101)
ZUEV, G. P., Extraction of U and rare earths, 16: 23793
ZUMWALT, L. R., Steady-state release of Kr and Xe fission products, 16: 24628
ZUROMSKY, G., Development and testing of enriched ceramic fuels, 16: 24625
ZVARA, I., Interactions of gaseous $ZrCl_4$, $HfCl_4$, $NbCl_5$ and $TaCl_5$, 16: 23709 (JINR-P-957)
ZWEIFEL, P. F., Localized source multiplication and reactor startup, 16: 24405
ZWEIFEL, P. F., Scattering resonances and reactor calculations, 16: 24387

SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries. A more complete description of the patterns and style of indexing used is included in the introductions to the subject index cumulations that are issued quarterly.

As an aid to the users of this index, references to report numbers, where appropriate, are included after the abstract number of the citation.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number in that volume. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. Published literature (journal article or book) is identifiable by the absence of a report number.

A

ABSTRACTS
for Japan conference on radioisotopes, October 1961, 16: 23354 (NP-11767)
on astronautics information, April 1962, 16: 25032 (NP-11619)
ACCELERATORS
cation, uses for material analysis and evaluation, 16: 23964 (ANL-6515(p.9-27))
design with vertically increasing field, 16: 24873
particle flux buildup in systems, phase conditions, 16: 24874
ACETIC ACID
properties as eluant for inorganic ion chromatography on zirconium phosphate paper, 16: 23650
ACETIC ACID, MERCAPTO-
oxidation, mechanism, 16: 23566
ACETIC ACID, PHENYL-
synthesis of carbon-14-labeled, equipment, 16: 23531
ACETONITRILE
reactions with methylcyclohexane and toluene to form complexes, 16: 23533
ACRYLIC ACID, BUTYL ESTER POLYMERS
diffusion across cellophane membrane, tracer study, 16: 23563
ACRYLONITRILES
polymerization in aqueous solution, effects of cupric salts, 16: 23737
radioinduced graft polymerization with polyethylene, 16: 23718(T) (AEC-tr-4321)
radioinduced graft polymerization on perchlorovinyl and polystyrene, 16: 23541
radioinduced graft polymerization on cotton cellulose, 16: 23544
radioinduced polymerization with methyl methacrylate and styrene, 16: 23739
radioinduced polymerization with allyl alcohol, 16: 23753
radioinduced polymerization in various solvents, carbanionic mechanism, 16: 23758
radioinduced polymerization with ethylene in toluene, 16: 23762
ACTINIC RADIATIONS
thermal properties, 16: 25031 (JPL-TR-32-232)
ACTIVATION ANALYSIS
applications, 16: 23649
data reduction, use of computers in, 16: 23632 (TID-7629(p.221-38))
uses for materials testing and research, 16: 23964 (ANL-6515(p.9-27))
uses in industry, 16: 23643(T) (AEC-tr-5116)
ADRENAL GLANDS
radiation effects on growth and function of regenerated or transplanted cortex in rat, 16: 23417(R) (TID-16122)
ADSORPTION
theory for radioisotope production, 16: 24080
ADVANCED ENGINEERING TEST REACTOR
criticality studies, 16: 24408
neutron flux distribution, 16: 24406
neutron importance in, mixed-spectra, 16: 24418
reactivity, 16: 24407
ADVANCED TEST REACTOR
control method and reflector materials for, selection, 16: 24487
control programming method for, graphical, 16: 24548
design, 16: 24488
AEROSOLS
precipitation, design of electronic filters for, 16: 24021(T) (CEA-tr-A-1002)
AGE ESTIMATION
radiometric methods and techniques, 16: 24007
AGRICULTURE
radiation hygiene problems in, 16: 24030
radiation research in Latin America, 16: 23427
AIR
analysis for beryllium, development of spark detector for, 16: 23615 (TID-7629(p.16-21))
analysis for chlorohydrocarbons, polarographic, 16: 23384 (TID-7616 (p.211-21))
analysis for uranium using 1-(2-pyridylazo)-2-naphthol, complexometric, 16: 23600 (CNI-57)
corrosive effects on stainless steel tubes, 16: 24125
electric conductivity, method for measuring, 16: 24282 (NP-11906)
properties as reactor coolant, 16: 23830 (BNL-5377)
radioactivity, from stack disposal of reactor wastes, 16: 25079
radioinduced nitrogen dioxide formation in liquid, by fast neutrons, 16: 24587
AIRCRAFT
radiation hazard from surface contamination, 16: 24022
ALBUMINS
preparation of tritium-labeled, by electric discharge, 16: 23551
radiation effects, review, 16: 23433
radiation effects on human serum, 16: 23412 (CEA-2132)
ALGAE
carbon dioxide uptake in heavy and light water, 16: 23364
ALKALI METAL HALIDE CRYSTALS
electron reactions with lattice in, constants for hyperfine F-center, 16: 24316
electron reactions with nuclei in double-resonance spectrum for F-center hyperfine, 16: 24317
review of developments in scintillation, 16: 23877
ALKALI METALS

solution chemistry, 16: 23529(R) (TID-16024)
ALKALI METALS (LIQUID)
corrosive effects on niobium base containment alloys, 16: 24165(R) (NP-11824)
ALKALINE EARTH METALS
solution chemistry, 16: 23529(R) (TID-16024)
ALKENES
synthesis of tritium-labeled, 16: 24581
ALLOYS
bibliography on high-strength, 16: 24111 (NP-11825)
neutron magnetic scattering by simple metal-transition metal, 16: 24333
X-ray scattering by binary distorted-fcc, effects of long-range order, 16: 24212
ALLYL ALCOHOLS
radioinduced polymerization with acrylonitrile, 16: 23753
ALPHA BEAMS
use in stimulating reflex action, 16: 23488
ALPHA PARTICLES
angular correlations and yields from proton reactions (p,α) at 730 to 1390 kev, 16: 24848
bioelectric effects on frog sciatic nerve at high energy, 16: 23486 (UCRL-9799)
detection and measurement in chemical process streams by solid-state counter, 16: 23902
effects on brain, from cyclotron, 16: 23492
effects on hematoencephalic barrier and cerebral blood vessels, 16: 23493
fusion reactions with heavy nuclei, energetics of, 16: 24350
reactions (α,n) with beryllium-9 at 4.3 to 5.6 Mev, neutron angular distributions and energies from, 16: 24852
reactions (α,n), ($\alpha,2n$), and ($\alpha,4n$) with nuclei at 19.7 to 46.2 Mev, angular distributions and ranges from, 16: 24853 (UCRL-9595-Rev.11)
reactions (α,p) with aluminum-27 at 4 Mev, angular distributions from, 16: 24828
scattering by nuclei, excitation from inelastic, 16: 24777 (CEA-2146)
ALPHA SPECTRA
measurement with semiconductor detector, 16: 23840 (CEA-2138)
ALUMINUM
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
corrosion, growth and initiation of pitting, 16: 24121 (KR-18)
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
electron transport at 0.4 to 4.0 Mev, Monte Carlo calculation of, 16: 24746
gamma attenuation in slabs, compared with Monte Carlo calculations, 16: 24906 (USNRDL-TR-558)
gamma-ray transmission through slabs, angular distribution of dose rate, 16: 24600
neutron activation, reactor spectra measurements by, 16: 24904 (DC-61-2-98)
neutron cross sections, corrections, 16: 24796 (UNC-5002)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
preparation in furnaces, determination of furnace efficiency, 16: 23812
proton reactions at 30 and 33 Bev, charged-particle production in, 16: 24858
proton reactions (p,γ), gamma dose after solar proton bombardment, 16: 24591
radiography of thin sections, technique for low-voltage, 16: 23980
radioinduced crosslinking with polymers, localized neutron, 16: 23720(T) (AEC-tr-5144)
reactor criticality effects, 16: 24407
separation from aqueous solutions by mixer-settlers, review, 16: 23793
ultrasonic propagation in deformed, 16: 23971 (ANL-6515(p.121-32))
X-ray scattering by pairs of disoriented crystal regions, 16: 24330
ALUMINUM ALLOY COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
ALUMINUM ALLOYS
analysis for silicon by fast neutron activation, 16: 24574
mechanical properties of dispersion strengthened, 16: 24171 (R61CAP69)
radiation effects on sintered, 16: 24235 (CRFD-1084)
ultrasonic propagation in deformed types 1100-F and 6061-T6, 16: 23971 (ANL-6515(p.121-32))
ALUMINUM–CHROMIUM–IRON ALLOYS
working characteristics, 16: 24156(R) (GV-298)
ALUMINUM COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
ALUMINUM COMPACTS
thermal properties, 16: 24464
ALUMINUM ISOTOPES Al-25
energy level lifetimes, 16: 24801
ALUMINUM ISOTOPES Al-26
energy level lifetimes, 16: 24801
ALUMINUM ISOTOPES Al-27
alpha reactions (α,p) at 4 Mev, angular distributions from, 16: 24828
deuteron reactions (d,αp) and (d,p) at 2.2 to 12.6 Mev, excitation functions for, 16: 24785 (NP-11748)
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
neutron reactions at 2 to 5 Mev, cross section fluctuations, 16: 24845
proton reactions (p,γ) at 1 Mev, gamma resonance yield curves, 16: 24824
proton reactions (p,α) and (p,γ) at 730 to 1390 kev, alpha yields from, 16: 24848
ALUMINUM ISOTOPES Al-28
half life, 16: 24785 (NP-11748)
ALUMINUM–LITHIUM–MAGNESIUM ALLOYS
phase transitions and tensile properties, 16: 24164 (NP-11778)
ALUMINUM–MAGNESIUM–SILICON SYSTEMS
aging and quenching characteristics, electron transmission microscopy, 16: 24194
ALUMINUM–NICKEL–PLUTONIUM ALLOYS
radiation stability, neutron, 16: 24640
ALUMINUM–NIOBIUM ALLOYS
oxidation by air, effects of metallic additives on, 16: 24174 (TID-16032)
ALUMINUM NITRATES
corrosion inhibition effects on stainless steel type 304-L in hydrofluoric-nitric acid mixtures, 16: 24120 (HW-73211)
ALUMINUM OXIDE COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
ALUMINUM OXIDE COMPACTS
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
ALUMINUM OXIDE–SILICON OXIDE SYSTEMS
phase studies, 16: 24148(R) (ASD-TR-61-676)
ALUMINUM OXIDE–ZIRCONIUM OXIDE SYSTEMS
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
ALUMINUM OXIDES
catalytic effects in hydrocracking to reclaim organic coolants, 16: 25018(R) (IDO-16761(p.1-74))
diffusion of xenon in, effects of fission recoil damage, 16: 24619
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
radiation effects of 1.2-Mev gammas at 70 to 400°F, 16: 24244 (TID-15981)
thermal expansion at 100 to 1100°K, linear, 16: 24190
ALUMINUM–PLUTONIUM ALLOYS
processing for americium and curium recovery, 16: 24343
radiation stability, neutron, 16: 24640
ALUMINUM–PLUTONIUM–SILICON SYSTEMS
radiation stability, neutron, 16: 24640
ALUMINUM POWDERS
creep-rupture of sintered, 16: 24149(R) (BMI-X-204)
heat of combustion, 16: 24139(R) (AD-269265)
ALUMINUM–SILICON COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
ALUMINUM–SILICON–TIN SYSTEMS
development as oxidation resistant coating for tantalum alloys,

16: 24163(R) (NP-11711)
ALUMINUM–SILICON–URANIUM SYSTEMS
phase studies of uranium-rich region, 16: 24217
ALUMINUM–STAINLESS STEEL COUPLES
corrosion, growth and initiation of pitting, 16: 24121 (KR-18)
ALUMINUM–THORIUM ALLOYS
corrosion and oxidation, 16: 24630
ALUMINUM–THORIUM–URANIUM ALLOYS
corrosion and oxidation, 16: 24630
ALUMINUM–TIN ALLOYS
development as oxidation resistant coating for tantalum alloys, 16: 24163(R) (NP-11711)
AMERICIUM
purification by ion exchange and precipitation, 16: 23696
separation from berkelium, californium, and einsteinium by phosphonate extraction, 16: 24345
separation from plutonium process waste, 16: 24343
tissue retention, effectiveness of various chelating agents on removal, 16: 23396
AMERICIUM ISOTOPES Am-241
separation from promethium-147 by ion exchange, 16: 23786 (ORNL-3271)
AMES RESEARCH REACTOR
hazards summary, preliminary, 16: 25024 (TID-14881)
AMIDE POLYMERS
diffusion of argon and helium in, radiation effects, 16: 24268
radiation effects on mechanical properties of tire cord, 16: 24262
AMMONIA
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
hydrogen isotope exchange with benzene, 16: 23569
reactions with uranium oxides and uranyl fluorides, thermodynamic characteristics of reduction in, 16: 24187
spectra of tritiated, rotational, 16: 23698
AMMONIA (LIQUID)
radiolysis of, gamma, 16: 23767
AMMONIUM BROMIDES
distribution of recoil carbon-14 from nitrogen-14 (n,p) reactions, 16: 23734
AMMONIUM CHLORIDES
distribution of recoil carbon-14 from nitrogen-14 (n,p) reactions, 16: 23734
AMMONIUM IRON(II) SULFATES
radiolysis, use for gamma dosimetry, 16: 23735
AMMONIUM SULFATES
distribution of recoil carbon-14 from nitrogen-14 (n,p) reactions, 16: 23734
AMMONIUM URANATES
thermal decomposition, formation of uranic acid in, 16: 23776(T) (AEC-tr-4939)
AMPLIFIERS
monitoring instrument reliability with, 16: 23861(T) (CEA-tr-A-1126)
ANALYSIS
book: *Isotopic Analysis of Waters*, in German, 16: 23661
conference on analytical chemistry in nuclear reactor technology, Gatlinburg, Tenn., October 10 to 12,1961, 16: 23613 (TID-7629)
development of radiochemical methods for, 16: 23528(R) (ORNL-3290)
ANEMIA
iron metabolism in, tracer study, 16: 23391
ANIMAL REPRODUCTION
effects of acute radiation sickness in monkeys, 16: 23522
effects of whole-body neutron exposure, in mice, 16: 23467
ANISOLE, 2,4-DINITRO-
methoxy exchange with methoxide ions, 16: 23562
ANP REACTORS
decontamination of D140 E, 16: 24976 (DC-60-10-726)
ANTENNAS
radome fabrication for, 16: 24132(R) (NP-11713)
ANTHRACENE
radiosensitivity effects on polyphenyls, 16: 25018(R) (IDO-16761(p.1-74))
ANTIBIOTICS
effects on lethally irradiated bacteria in nutritious and non-nutritious media, 16: 23425
ANTIMONY
determination in biological materials, activation, 16: 23403
determination in pharmaceuticals, activation, 16: 23646
neutron total cross sections at 0.003 to 0.008 ev, 16: 24811
separation of fission product, radiochemical, 16: 24564
ANTIMONY CHLORIDES
distribution and excretion of antimony-124 labeled, in dogs, rabbits, and rats, 16: 23386 (UR-608)
ANTIMONY–INDIUM ALLOYS
electron energy-loss spectra in, 16: 24329
ANTIMONY ISOTOPES Sb-113
decay scheme, electron-capture and positron emission, 16: 24832
ANTIMONY ISOTOPES Sb-121
deuteron reactions (d,2n) at 9 to 28 Mev, effective cross sections for production of tellurium-121 isomeric pairs in, 16: 24786 (NP-11791)
ANTIMONY ISOTOPES Sb-124
distribution and excretion in dogs, rabbits, and rats, 16: 23386 (UR-608)
ANTIMONY ISOTOPES Sb-127
gamma spectra, half life, and mass, 16: 24805
ANTIMONY ISOTOPES Sb-128
gamma spectra, half life, and mass, 16: 24805
ANTIMONY ISOTOPES Sb-129
gamma spectra, half life, and mass, 16: 24805
ANTINEUTRINOS
scattering by electrons, two-body approximation of elastic, 16: 24688 (JINR-P-947)
ANTINUCLEONS
interactions with nucleons, selection rules for integral-isospin meson production in, 16: 24735
ANTIPROTONS
interactions with protons, meson (π) asymmetry energy dependence in, 16: 24730
interactions with protons at high energies, radius lower limit calculation for, 16: 24740
interactions with protons, meson (π) resonances from, 16: 24750 (UCRL-9814)
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
ANTIPYRINE, 4-IODO-
iodine exchange, solvent effects, 16: 23573
APATITES
crystal structure and properties, 16: 23997
ARGON
alkali-atom electron-spin-resonance spectra in, at 4.2°K, 16: 23702
determination in carbon dioxide, radiometric, 16: 23598 (ARDC/P.36)
diffusion in polymers, radiation effects, 16: 24268
electric conductivity decay measurements in plasma, 16: 24881 (AFCRL-1119)
electric discharge in, channel brightness, 16: 24289(T) (NP-tr-898)
electron diffusion and mobility in, 16: 24281 (NP-11846)
ionization by metastable helium atoms, cross sections, 16: 24296
spreading characteristics in plasma jet, 16: 24879 (AEDC-TDR-63-88)
vapor pressure of solid, at 72 to 83.78°K, 16: 24311
ARGON ISOTOPES Ar-36
separation from argon-40 by vapor-pressure differences in solid state, 16: 24311
ARGON ISOTOPES Ar-37
determination in meteorite, to analyze spatial variations of cosmic ray flux, 16: 24668
ARGON ISOTOPES Ar-39
determination in meteorite, to analyze spatial variations of cosmic ray flux, 16: 24668
ARGON ISOTOPES Ar-40
separation from argon-36 by vapor-pressure differences in solid state, 16: 24311
ARMY REACTORS (ML-1)
fuel element heat transfer, local film coefficients due to boundary layer turbulence promoters, 16: 24504
ARMY REACTORS (PL-2)
design of gas handling and refueling equipment for, 16: 24970 (CEX-

136(Vol.I Suppl.))
ARMY REACTORS (PM-1)
design of core, final report, 16: 24983(R) (MND-M-1866)
ARMY REACTORS (PM-2)
hazards analysis of effects of core II, 16: 24966 (APAE-121)
startup at remote arctic site, 16: 24494
thermal analysis of Type 3 replacement cores, 16: 24965 (APAE-105)
ARMY REACTORS (PM-3)
shielding material and leach water, activation analysis, 16: 24996 (TID-15477)
ARMY REACTORS (SL-1)
accident January 3, 1962, 16: 25021 (IDO-19308)
core and pressure vessel examination after accident, 16: 24512
examination after accident, 16: 24513
mechanical and nuclear effects in accident, correlation of, 16: 24514
recovery operation after accident, 16: 24511
ARMY REACTORS (SM-1)
fuel element development, 16: 24477
thermal analysis of Type 3 replacement cores, 16: 24965 (APAE-105)
ARSENIC
determination in biological materials, activation, 16: 23403
determination in copper alloys and organic materials, radioisotope methodology in, 16: 24565
determination in lead-free steel, spectrographic, 16: 23597 (AERE-R-3974)
determination in pharmaceuticals, activation, 16: 23646
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
neutron total cross sections at 0.003 to 0.008 ev, 16: 24811
ARSENIC ISOTOPES As-76
separation from water by adsorption on minerals, 16: 25035 (HW-69225)
ARTHROPODS
identification of *Hypoaspis marksi*, 16: 23363
ASPARTIC ACID
complexing with uranyl ion, bonding and stability constants, 16: 23387 (UR-611)
ASTATINE ISOTOPES At-201
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-202
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-203
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-204
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-205
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-206
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-207
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-208
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTATINE ISOTOPES At-211
fission-spallation competition in, 16: 24854 (UCRL-9950)
ASTRONAUTICS
bibliography, abstracts for April 1962, 16: 25032 (NP-11619)
ASTROPHYSICS
analysis of type II and III solar radio bursts, 16: 24656 (ML-879)
neutrons in, 16: 24659
ATMOSPHERE
analysis for radon, Geiger-Mueller counter for, 16: 23833 (AEET/AM/24)
beta activity of Italian, 16: 23093
cosmic meson (μ) absorption, effects on intensity at 40 mwe, 16: 24670
cosmic particle acceleration in outer, theory, 16: 24671
diffusion in ground layer, turbulent, 16: 23991(T) (AWRE-Trans-34)
properties and vehicle motion in, transport equations for, 16: 23989 (ZPA-108)
radiation dispersion in, graphs for estimating, 16: 23986 (ORO-545)
ATMOSPHERES
in reactors, leakage control, 16: 24498
ATOMIC ENERGY
bibliography on, 16: 23358 (TID-3711)
conference on science in the advancement of new states, Rehovoth, Israel, August 1960, German translation, 16: 23361
educational aspects of medicine in, 16: 23366 (BNL-4931)
insurance problems, 16: 24025
ATOMIC ENERGY COMMISSION
waste disposal, land burial, 16: 25062 (TID-7628(p.396-427))
ATOMIC ENERGY OF CANADA LTD. CHALK RIVER PROJECT, CHALK RIVER, ONT.
waste disposal facilities, 16: 25038 (TID-7628(p.3-9))
ATOMIC EXPLOSIONS
blast effects on German underground personnel shelters, 16: 24020 (WT-1454)
effects on AEC prototype communal shelter, 16: 23359 (WT-360)
thermal radiation measurements, equipment and methods for, 16: 23854 (WT-543)
thermal radiation measurements using passive indicators, 16: 23855 (WT-544)
ATOMS
energy level (nl) configuration of, 2nd-order hyperfine and Zeeman interaction corrections for, 16: 24324
photoelectric effect, cross sections and polarization effects, 16: 24294
AURORAL STORMS
measurements during Nov. 1960, 16: 24306
AUSTENITE
stability in steels, effects of cooling process, 16: 24197

B

BACTERIA
effects of deuterium oxide, 16: 23388
effects of deuterium oxide, 16: 23404
radiation effects on coecolytes and coliforms in milk, 16: 23455
radiation effects, post-irradiation effects of nutritional substances, 16: 23457
radiation effects in spores, 16: 23458
radiation effects in cocarboxylase hydrochloride, 16: 23424
radiosensitivity in nutritious and non-nutritious media, effects of antibiotics, 16: 23425
BARITE CONCRETES
preparation and shielding properties, 16: 24229
BARIUM
content in human bones and diet, 16: 23370 (AERE-R-4035)
determination in strontium-90 recovery samples, methods for, 16: 23601 (HW-69677)
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
ion exchange with cesium, tracer study, 16: 25048 (TID-7628(p.179-86))
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
BARIUM CARBONATES
carbon exchange with potassium cyanide, 16: 23558
radium isotope distribution in, effects of radium-228 decay scheme on, 16: 23990(T) (AEC-tr-5159)
BARIUM CHROMATES
radium isotope distribution in, effects of radium-228 decay scheme on, 16: 23990(T) (AEC-tr-5159)
BARIUM HAFNATES
effects on phase transitions of lead hafnate, 16: 23688
BARIUM ISOTOPES Ba-140
accumulation in trees, use in studying soil contamination, 16: 23406 (CEA-2131)
production of carrier-free, by solid solutions, 16: 24084
BARIUM SULFATES
radium isotope distribution in, effects of radium-228 decay scheme on, 16: 23990(T) (AEC-tr-5159)
strontium ion exchange with solution, 16: 23575
BARIUM TITANATE CRYSTALS
dielectric constants at 70 to 5000 cm^{-1} in, 16: 24321
BARLEY
radiosensitivity of seed, 16: 23469
BEARINGS
book: *Gas Film Lubrication*, 16: 23813

lubrication problems of gyro, tracer study, 16: 24582
wear of turbo-assembly suspension-type, tracer studies, 16: 24037(T) (AEC-tr-5189)
BEHAVIOR
effects of irradiation of head, 16: 23474
radiation-conditioned, 16: 23510
radiation effects, review, 16: 23506
radiation effects on learning, *in utero* exposure, 16: 23507
radiation effects on learning in neonatal rats, 16: 23508
radiation effects, cranial exposure, 16: 23509
radiation effects, 16: 23511
radiation effects in monkeys and chimpanzees, 16: 23513
radiation effects on psychologic processes in monkeys, 16: 23514
BELGIAN REACTOR-2
fuel consumption rates and thermal neutron cross section calculations, 16: 25013 (BLG-69)
fuel element flow tests, 16: 24985 (NDA-2561-1)
safety, maximum credible accident without sodium combustion, 16: 25014 (BLG-99)
BELGIUM
radioisotope production and use in, 16: 24049
BENTONITES
effects on permeability of soil by moisture, 16: 25066 (TID-7628(p.462-8))
BENZENE
hydrogen isotope exchange with ammonia, 3: 23569
preparation of tritium-labeled, by electric discharge, 16: 23551
reactions with recoil tritium, 16: 23549
solvent properties for mercury, 16: 23591
BENZENE, BROMO-
solvent properties for mercury, 16: 23591
BENZENE, CHLORO-
radiolysis, sulfur-35 activity in yields from neutron, 16: 23719(T) (AEC-tr-5093)
solvent properties for mercury, 16: 23591
BENZENE, DICHLORO-
preparation of tritium-labeled, by electric discharge, 16: 23548
BENZENE, 2,4-DINITRO-1-IODO-
iodine exchange with iodide ions, 16: 23562
BENZENE, ETHYNYL-
radioinduced polymerization by electrons, 16: 23757
BENZENE, IODO-
synthesis of iodine-labeled, 16: 23559
BENZENE, NITRO-
solvent properties for gallium(III) and indium(III) ions from acid solutions, 16: 23582
solvent properties for mercury, 16: 23591
BENZENESULFONIC ACID, *p*-IODO-
synthesis of iodine-131-labeled anhydride, 16: 23560
BENZENETHIOL
yields in sulfur-35 reactions with chlorobenzene, 16: 23719(T) (AEC-tr-5093)
BENZOIC ACID
preparation of tritium-labeled, by electric discharge, 16: 23548
synthesis of carbon-14-labeled, equipment, 16: 23531
BERKELIUM
separation from americium and curium by phosphonate extraction, 16: 24345
BERYLLIUM
analysis for minor elements in ultrapure, by neutron activation, 16: 23634 (TID-7629(p.245-57))
bibliography on structural applications, 16: 24096 (DMIC-168)
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
determination in atmosphere, development of spark detector for, 16: 23615 (TID-7629(p.16-21))
determination on filter paper discs, development of automated spectrograph for, 16: 23614 (TID-7692(p.1-15))
monitoring of air-borne, activation method, 16: 24571
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
nondestructive testing of hot pressed, for use as inertial instruments, 16: 23979
properties and structure, tables, 16: 24218
proton reactions at 30 and 33 Bev, charged-particle production in, 16: 24858
radiography of thin sections, technique for low-voltage, 16: 23980
radiography, radiopaque penetrant for, 16: 23978
reactor criticality effects, 16: 24407
reactor reflector critical thickness, 16: 24410
spectra of singly ionized, at 1500 to 12,100 Å, 16: 24292
BERYLLIUM ALLOYS
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
BERYLLIUM CRYSTALS
thermal expansion at 77 to 273°K, anisotropic, 16: 24193
BERYLLIUM FLUORIDE–LITHIUM FLUORIDE–SODIUM FLUORIDE SYSTEMS
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
BERYLLIUM FLUORIDE–LITHIUM FLUORIDE SYSTEMS
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
BERYLLIUM FLUORIDE–LITHIUM FLUORIDE–URANIUM(IV) FLUORIDE SYSTEMS (LIQUID)
solvent properties for rare earth fluorides, 16: 23595
BERYLLIUM FLUORIDE–SODIUM FLUORIDE SYSTEMS
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
BERYLLIUM ISOTOPES Be-7
content in rainfall at Westwood, N. J., 16: 23985 (NYO-9532)
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
yields in proton spallation of copper at 24 Bev, 16: 24859
BERYLLIUM ISOTOPES Be-9
alpha reactions (α,n), low-energy neutron yield from, 16: 24388
alpha reactions (α,n) at 14.2 Mev, angular distributions, 16: 24804
alpha reactions (α,n) at 4.3 to 5.6 Mev, neutron angular distributions and energies from, 16: 24852
bremsstrahlung reactions (γ,p) at 16.89 to 57 Mev, cross sections for, 16: 24857 (IS-357)
deuteron reactions (d,n) spectral measurements from, 16: 23934
deuteron reactions (d,n), neutron yields from, 16: 23964 (ANL-6515(p.9-7))
deuteron reactions (d,p) at 10 Mev, proton polarization, 16: 24816
deuteron reactions (d,n) and (d,nγ), cross sections, 16: 24830
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
neutron reactions (n,2n), yields from, 16: 24388
proton reactions (p,n), neutron yields from, 16: 23964 (ANL-6515(p.9-7))
synthesis in early history of solar system, 16: 24658
BERYLLIUM MODERATED REACTORS
criticality studies of hydrogen-containing, 16: 24411
criticality studies of hydrogen-containing, 16: 24412
reactivity, effects of moderator voids on, 16: 24420
BERYLLIUM–NIOBIUM ALLOYS
oxidation of $NbBe_{12}$ and Nb_2Be_{17} at 1200 to 2000°F, 16: 24123 (TID-16030)
BERYLLIUM NITRIDES
distribution of recoil carbon-14 from nitrogen-14 (n,p) reactions, 16: 23734
BERYLLIUM OXIDE POWDERS
analysis for impurities, development of methods for emission spectrographic, 16: 23624 (TID-7629(p.135-41))
BERYLLIUM OXIDE–THORIUM OXIDE–URANIUM OXIDE SYSTEMS
diffusion of xenon-133 and -135 from neutron irradiated, 16: 24144 (AERE-R-4062)
BERYLLIUM OXIDE–URANIUM(IV) OXIDE COMPACTS
diffusion of xenon-133 and -135 from neutron irradiated, 16: 24144 (AERE-R-4062)
BERYLLIUM OXIDE–URANIUM OXIDE SYSTEMS
differential thermal analysis, 16: 23652
BERYLLIUM OXIDE–URANIUM(IV) OXIDE SYSTEMS
oxidation, 16: 24622
radiation effects testing, 16: 24623
radiation stability of Hastelloy-clad, 16: 24637
BERYLLIUM OXIDES
bibliography, 1955 to 1961, 16: 24140 (AD-269729)
radiation effects, 16: 24238(R) (GEMP-12A)
radiation effects experiments, design of ORNL 41-8 and -9, 16: 24100 (ORNL-3310)

radiography, radiopaque penetrant for, 16: 23978
reactor criticality effects of void-containing, 16: 24420
reactor reflector critical thickness, 16: 24410
BERYLLIUM–THORIUM ALLOYS
corrosion and oxidation, 16: 24630
BERYLLIUM–THORIUM–URANIUM ALLOYS
corrosion and oxidation, 16: 24630
BERYLLIUM–ZIRCONIUM ALLOYS
oxidation of $ZrBe_{13}$ and Zr_2Be_{17} at 1200 to 2000°F, 16: 24123 (TID-16030)
BETA DECAY
bremsstrahlung emission in, effect of Coulomb field on internal, 16: 24802
momentum spectra, in meson (μ^-) decay, 16: 24725
of mesons (π), conserved vector current theory of, 16: 24691 (JINR-P-968)
BETA PARTICLES
detection and measurement of low-level, design of Geiger-Mueller tube for, 16: 24011 (DP-711)
detection and measurement, thin-film technique for, 16: 23939
distribution in air at stations along the 80th (west) meridian, 16: 24012(R) (HASL-127)
dosimetry, 16: 23378 (TID-7616(p.79-88))
effects on central nervous system, 16: 23480
effects on compound action potentials of mammalian nerves, 16: 23504
effects on foods, 16: 24040
pair production in meson (π^0) decay, 16: 24749
pathological effects, from implanted phosphorus-32 grains, 16: 23365
BETA SOURCES
preparation of fission-product, 16: 24698(R) (RAI-201)
BETA SPECTROMETERS
design and performance of iron-free, 16: 23959
design for use in space, 16: 23928
development for low-level counting, 16: 23958
BIBLIOGRAPHIES
on age estimation in geology, 16: 24007
on astronautics information, April 1962, 16: 25032 (NP-11619)
on atomic energy literature, 16: 23358 (TID-3711)
on beryllium oxide, 1955 to 1961, 16: 24140 (AD-269729)
on beryllium structural applications, 16: 24096 (DMIC-168)
on bubble studies, 16: 24274 (CEA-BIB-26)
on degradation and fracture of plastics, 16: 24112 (PLASTEC-NOTE-2)
on determination of uranium in iron and steel alloys, 16: 23604 (NP-11873)
on diffusion in ceramic systems, 16: 24157 (IS-448)
on electric propulsion research, 16: 25030 (AFOSR-1632)
on geology of thorium and uranium, 16: 24008 (STI/PUB/21/4)
on high-pressure effects on solid materials, 16: 24115
on high-temperature chemistry, 16: 23677
on iodine-132, 1939 to 1961, 16: 23665 (BLG/B-2)
on iodine-133, 1939 to 1961, 16: 23666 (BLG/B-3)
on magnetohydrodynamic fluids and cells, 16: 24884 (ASD-TDR-62-259)
on materials for nuclear superheat uses, 16: 24155 (GEAP-3875)
on metals, nonmetals, and high-strength alloys, 16: 24111 (NP-11825)
on molybdenum disulfide lubricants, 16: 24167 (NP-11899)
on neutron radiation effects on nonfissionable alloys and metals, 16: 24269 (STI/PUB/21/6)
on pulse analyzers, 16: 23911 (BNL-5993)
on pulse-height spectra analysis in gamma scintillation spectroscopy, 16: 23914
on pulse shape discrimination in scintillation detectors, 16: 23913
on radiation effects on insects, 16: 24053
on radiation effects on materials, 16: 24233 (57GL77)
on radiation effects on electronic components, 16: 24241 (NP-11852)
on radiation effects, 16: 24242 (NP-11856)
on radiation effects on polymers, 16: 23752
on radiation effects on nervous system, Russian research, 16: 23487
on reactor fuel processing and waste disposal, I, 16: 23784 (ORNL-2971(Vol.1))
on reactor fuel processing and waste disposal, III, 16: 23785 (ORNL-2971(Vol.3))
on scandium geochemistry and mineralogy, 16: 24000
on semiconductor detectors, 16: 23894
on soil density and moisture measurements by nuclear methods, 16: 23982 (AERE-Bib-140)
on spark chambers, 16: 23907
on thermodynamic properties of nitrogen and oxygen, 16: 23664 (ASD-TR-61-625)
on use of semiconductor detectors, 16: 23895
papers, publications, and reports for 1961 from Oak Ridge National Laboratory, 16: 23355 (ORNL-3300(Vol.1))
BIG ROCK POINT POWER REACTOR
scheduling computer system for, 16: 24545
BILE DUCT
diagnosis of hepatic vesicular affections with colloidal gold-198 and iodine-131-labeled Rose Bengal in, 16: 23371 (CEA-1994)
BIOCHEMISTRY
conference on bio-assay, 16: 23372 (TID-7610)
BIOLOGICAL MATERIALS
analysis for arsenic, radioisotope methodology in, 16: 24565
analysis for trace metals, activation, 16: 23403
BIOLOGICAL MODELS
lung, clearance and deposition properties, 16: 23382 (TID-7616(p.133-46))
BIOLOGICAL SYSTEMS
radiation effects, 16: 23418 (TID-16219)
strain and stress relations of heat in, physiological indexes, 16: 23376 (TID-7616(p.61-8))
BIOLOGY
conference on science in the advancement of new states, Rehovoth, Israel, August 1960, German translation, 16: 23361
BIPHENYL
properties as reactor coolant, 16: 23830 (BNL-5377)
properties, physical and thermodynamic, 16: 24461
separation from terphenyls, methods for, 16: 23603 (JEN-91-DQ/I-25)
BIPHENYL–PHENYL ETHER SYSTEMS
moderating properties at 10 to 260°C, 16: 24774
properties as reactor coolant, 16: 23830 (BNL-5377)
BIRDS
radiation effects on brain, comparison of sensitivity of various parts, 16: 23421(T) (AEC-tr-5141)
BISMUTH
analysis for tellurium, chromatographic, 16: 23602 (IA-639)
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
neutron lifetimes in, fast, 16: 24424
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
solvent properties for long-lived fission products at 300 to 700°C, 16: 24216
BISMUTH–GRAPHITE SYSTEMS
neutron diffusion lengths in, 16: 24375
BISMUTH IONS
sorption of recoil, at surface layer of sodium dodecyl sulfate solution, 16: 23585
BISMUTH ISOTOPES Bi-209
charged particle fission, energetics of, 16: 24350
neutron photoproduction cross sections, 16: 24778 (CEA-2148)
BISMUTH ISOTOPES Bi-210
beta decay, use in synthesis of polonium organic compounds, 16: 23721(T) (AEC-tr-5149)
BISMUTH–LEAD ALLOYS
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
BISMUTH TELLURIDES
mobilities of electrons and holes in, at 80 to 600°K, 16: 24213
BLAST EFFECTS
on animals and dummies, 16: 24017 (WT-798)
on family and personnel type shelters, evaluation, 16: 24018 (WT-1161)
on structures, instrumentation for measuring, 16: 23856 (WT-790)
BLOOD
extracorporeal irradiation of circulating, 16: 23434 (BNL-6011)
radiation effects, 16: 23511

BLOOD CIRCULATION
measurement, tracer method using krypton-85, 16: 23362
time studies with cardiac catheters and radioactive tracers, 16: 23395
BLOOD DISEASES
iron metabolism in, tracer study, 16: 23391
BLOOD PICTURE
effects of heparin, 16: 23434 (BNL-6011)
radiation effects, 16: 23434 (BNL-6011)
radiation effects, 16: 23445
radiation effects, whole-body exposure, 16: 23446
radiation effects in dogs, partial or whole-body, 16: 23419 (UR-609)
BLOOD PLASMA
radiation effects on iron metabolism, tracer study, 16: 23430
radiation effects on proteins in human, 16: 23412 (CEA-2132)
BLOOD PLATELETS
survival of stored and transfused in thrombocytopenic recipients, 16: 23526
BLOOD SERUM
protein polarographic activity during radiation sickness, 16: 23516(T) (JPRS-13639)
toxic effects of, from irradiated animals, effects of drugs, 16: 23440
BLOOD VESSELS
radiation effects, 16: 23493
radiosensitivity of skin, 16: 23518
reactions to irradiation, effects of innervation control, 16: 23438
BOILING
flow of boiling liquids in tubes, 16: 23825
heat transfer in flow of boiling liquid in annulus, 16: 23828
BOILING REACTOR EXPERIMENTS
fuel element fabrication, 16: 24635
BOILING REACTORS
control by coolant flow regulation, 16: 24960(P)
control of, with internal nuclear superheater, 16: 24531
design for improved reactivity control, 16: 24958(P)
heat transfer and hydraulics in, 16: 24931(R) (ANL-6561)
large amplitude steam void oscillations under forced flow, 16: 24534
startup transients, 16: 24530
BONE MARROW
effectiveness of injections, in treatment of radiation sickness, 16: 23525
radiation effects on cytology and structure in rats, whole-body, 16: 23429 (BNL-5032)
radiation effects on lipid metabolism, 16: 23415(R) (TID-16080)
therapeutic effects on lethally irradiated mice, 16: 23521
BONE TUMORS
induction by injected strontium-90 in mice, 16: 23464 (UAC-4763)
BONES
accretion rate in spinal fractures, tracer study, 16: 23394
analysis of reindeer, for strontium-90, 16: 23402
barium and strontium content in human, 16: 23370 (AERE-R-4035)
deposition of strontium-90, effects of kinetics of administration, 16: 23441
sorptive properties for plutonium oxide, 16: 23381 (TID-7616(p.127-32))
BORON
additive effect on concrete shielding, 16: 24224
additive effects on concrete shielding, 16: 24222
determination by neutron activation method, use for boron-containing material identification, 16: 24572
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
BORON CARBIDE–NICKEL COMPACTS
corrosion in high-temperature water, 16: 24107 (GEAP-3831)
radiation effects on properties, 16: 24107 (GEAP-3831)
BORON CARBIDES
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
BORON–CARBON SYSTEMS
analysis for gaseous molecules in, spectrometric, 16: 24177 (WADD-TR-60-782(Pt.VIII))
BORON ISOTOPES B-10
abundance relative to boron-11, 16: 23537
energy level at 5.159 Mev, partial gamma widths, 16: 24830
energy level lifetimes, 16: 24801
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
synthesis in early history of solar system, 16: 24658
BORON ISOTOPES B-11
abundance relative to boron-10, 16: 23537
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
proton reactions (p,α), spectra of, 16: 23840 (CEA-2138)
synthesis in early history of solar system, 16: 24658
BORON OXIDE–SILICON OXIDE SYSTEMS
phase studies, 16: 24148(R) (ASD-TR-61-676)
BORON–SILICON SYSTEMS
analysis, chemical, 16: 23599 (ARL-180)
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
BORON–THORIUM–URANIUM SYSTEMS
corrosion and oxidation, 16: 24630
BRAIN
radiation effects on cerebral cortex of fetal white rat, 16: 23473
radiation effects in rats, 16: 23474
radiation effects in newborn rats, head exposure, 16: 23475
radiation effects on growth in newborn rats, 16: 23477
radiation effects, damage sequence in mice, 16: 23481
radiation effects, high-dose gamma, 16: 23484
radiation effects of protons at 185 Mev, 16: 23489
radiation effects of alpha particles from cyclotron, 16: 23492
radiation effects on hematoencephalic barrier and cerebral blood vessels, 16: 23493
radiation effects of neutrons in capture therapy, 16: 23495
radiation effects on electrical activity, 16: 23505
radiation injury detection using fluorescein dye, 16: 23491
radiosensitivity, comparison of various parts, 16: 23421(T) (AEC-tr-5141)
study of cerebral cortex by producing laminar lesions with a deuteron beam, 16: 23490
BREEDER REACTORS
design and economics of 315-Mw fast, 16: 24478
development review, 16: 25011
fuel element design for improved breeding of uranium-233, 16: 24959(P)
fuel materials, evaluation of fused plutonium and uranium chlorides, 16: 25002(T) (AEC-tr-5161)
BREMSSTRAHLUNG
emission in beta decay, effect of nuclear Coulomb field on, 16: 24802
intensity measurements with ionization chambers, 16: 23959
polarization of quasi-monochromatic, by passage through single crystals, 16: 24756
relation to plasma friction, 16: 24898
scattering by nuclei, resonant, 16: 24703
BROMINE
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
reactions with formic acid, deuterium isotope effects in photochemical, 16: 23567
separation of fission product, radiochemical, 16: 24564
BROMINE COMPLEXES
decomposition, effects of bromine-80m isomeric transitions in, 16: 23764
BROMINE ISOTOPES Br-79
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
BROMINE ISOTOPES Br-80
neutron reactions (n,γ), isotope effects and secondary reactions in methane derivatives, 16: 23723(T) (AEC-tr-5151)
BROMINE ISOTOPES Br-81
neutron reactions (n,γ) in hexabromoethane, fate of bromine-82 atoms, 16: 23733
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
BROMINE ISOTOPES Br-82
neutron reactions (n,γ), isotope effects and secondary reactions in methane derivatives, 16: 23723(T) (AEC-tr-5151)
yields from alpha and deuteron fission of uranium-233, 16: 24351
BROMINE ISOTOPES Br-87
decay scheme, 16: 24567

BUBBLE CHAMBERS
design with scintillation detector for mesons(K^+), 16: 23919
development and use of scintillation propane, 16: 23878
distortion in, effects on measurements at high momenta, 16: 24718
film measurement and scanning, design of instrument for, 16: 23851 (UCRL-10109)
hazards of hydrogen, study, 16: 24015 (TID-15985)
operation, bibliography on, 16: 24274 (CEA-BIB-26)
BUBBLES
bibliography, 16: 24274 (CEA-BIB-26)
velocity of rising steam in bubbling two-phase mixture, 16: 24510
BUILDING MATERIALS
analysis for water by gamma absorption, 16: 24048
BUSTER OPERATION
communal shelter evaluation, 16: 23359 (WT-360)
1,3-BUTADIENE, 2-METHYL POLYMERS
reactions with sulfur, 16: 23538
BUTADIENE POLYMERS
reactions with sulfur, 16: 23538
BUTANE
dehydrogenation kinetics, 16: 23568
radiolysis, absolute hydrogen yields in gamma, 16: 23730
BUTENES
dehydrogenation kinetics, 16: 23568
BUTYL PHOSPHATE COMPLEXES
formation in solvent extraction of nitric acid and uranyl nitrate, mechanism, 16: 23797
BUTYL PHOSPHATE–HEXANE SYSTEMS
solvent properties for nitric acid and water, 16: 24646
BUTYL PHOSPHATES
determination in kerosene by infrared spectrometry, 16: 23612 (PG-Report-344)
solvent properties for niobium-95, 16: 23787 (ORNL-3285)
BUTYRIC ACID, METHYL ESTER
preparation, 16: 24147 (ASD-TDR-62-90)

C

CABLES
defect detection in telephone, with radioisotopes, 16: 24062
CADMIUM
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
determination in zirconium by radioactivation analyses, 16: 23633 (TID-7629(p.239-44))
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-366)
CADMIUM CHLORIDES
displacement of zinc chloride on anion exchangers, frontal analysis and development, 16: 23673(T) (AEC-tr-5098)
CADMIUM FLUORIDE CRYSTALS
spectra of ytterbium ions in, absorption and electron paramagnetic resonance, 16: 24334
CADMIUM IONS
electrochemical activity coefficients, 16: 23534
reactions with Dowex 50 resin cation exchanger, equilibrium constants, 16: 23534
CADMIUM ISOTOPES Cd-111
energy level crossing in magnetic fields, 16: 24850
CADMIUM ISOTOPES Cd-113
energy level crossing in magnetic fields, 16: 24850
CADMIUM SULFIDES
radiation effects on electrical and optical properties, 16: 24234 (ARL-62-343)
CADMIUM TELLURIDES
radiation effects on electrical and optical properties, 16: 24234 (ARL-62-343)
CALCIUM
content in clams in Clinch and Tennessee Rivers, 16: 23410 (ORNL-TM-270)
determination in strontium-90 recovery samples, methods for, 16: 23601 (HW-69677)
determination in zirconium by radioactivation analyses, 16: 23633 (TID-7629(p.239-44))
intestinal absorption, effects of alkaline earths and pH, tracer study, 16: 23398 (HW-SA-2519)
movement in peppermint plant, 16: 23389
properties, structure, and uses review, 16: 24114 (IS-223)
self-diffusion in melts containing silica and sodium oxide, lithium oxide, calcium oxide, and potassium oxide, 16: 24038(T) (AEC-tr-5191)
separation from low-level wastes by precipitation, 16: 25036 (ORNL-TM-260)
CALCIUM CHLORIDES
additive effects on spin-lattice relaxation in glycerine-titanium chloride 16: 23703
CALCIUM FLUORIDE–THORIUM FLUORIDE SYSTEMS
electric and ionic conductivity at 1100°C, 16: 23672 (PAN-287/IV)
CALCIUM FLUORIDE–THORIUM FLUORIDE–ZINC FLUORIDE SYSTEMS
electric and ionic conductivity at 1100°C, 16: 23672 (PAN-287/IV)
CALCIUM ISOTOPES Ca-40
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
neutron reactions, cross section resonances, 16: 24818
CALCIUM ISOTOPES Ca-45
determination using liquid scintillation counters, 16: 24337
yields in proton spallation of copper at 24 Bev, 16: 24859
CALCIUM ISOTOPES Ca-47
angular correlations, 16: 24794(R) (TID-15211)
yields in proton spallation of copper at 24 Bev, 16: 24859
CALCIUM OXIDE–NIOBIUM OXIDE SYSTEMS
crystal structure and phase studies, 16: 24191
CALCIUM OXIDE–URANIUM OXIDE–ZIRCONIUM OXIDE SYSTEMS
properties as reactor fuel, 16: 24625
CALCIUM OXIDES
diffusion of calcium, potassium, and sodium ions in, in melts with silicon oxide-sodium oxide systems, 16: 24038(T) (AEC-tr-5191)
stabilization of zirconium oxides with, effects of iron oxide on, 16: 24203
CALCIUM SULFATES
strontium ion exchange with solution, 16: 23575
CALDER HALL REACTORS
neutron flux transient behavior, 16: 25004(T) (AERE-Trans-888)
CALIFORNIUM
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
separation from americium and curium by phosphonate extraction, 16: 24345
CALORIMETERS
design and operation of liquid metal solution, 16: 23949
design and performance for measuring thermal radiation from atomic explosions, 16: 23854 (WT-543)
design and performance of in-line, for microwave power measurements, 16: 24868 (TID-16053)
design of high-temperature-drop, for measuring heat contents at 1000 to 2500°C, 16: 23951
CAMERAS
design and operation of high-speed spark light source, 16: 23852 (UTIA-TN-26)
design of high-speed rotating-mirror, 16: 23935
design of rotating-mirror smear camera for arc discharge study, 16: 23936
CANADA
nuclear power development, growth of, 16: 24978 (DL-49)
CANDU REACTOR
economic analysis, 16: 24453
CARBIDES
properties evaluation for use as thermionic emitters, 16: 24154(R) (GA-3245)
CARBON
electron transport at 0.4 to 4.0 Mev, Monte Carlo calculation of, 16: 24746
exchange between carbonates and potassium cyanide, 16: 23558
exchange between methane and sorbed methane in molybdenum films, 16: 23576

exchange in methoxy exchange with 2,4-dinitroanisole, 16: 23562
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
metallurgical effects on diffusion of chromium in steel, 16: 24199
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
reactor criticality effects, 16: 24407
CARBON COATINGS
deposition on ceramic fuel elements, 16: 24626
CARBON DIOXIDES
analysis for argon, radiometric, 16: 23598 (ARDC/P.36)
electron diffusion and mobility in, 16: 24281 (NP-11846)
electron diffusion in, at low energies, 16: 24325
properties as reactor coolant, 16: 23830 (BNL-5377)
reactions with graphite, 16: 23678
reactions with Grignard reagents, equipment, 16: 23531
uptake by algae in heavy and light water, 16: 23364
CARBON ISOTOPES C-12
alpha stripping reactions (α,p) at 16 to 40 Mev, cross sections, 16: 24838
determination of cosmic-ray-induced in meteorites, 16: 23984 (NYO-8922)
deuteron reactions (d,p) at 10 Mev, proton polarization, 16: 24816
gamma reactions (γ,n) at 30 to 80 Mev, 16: 24842
gamma reactions (γ,n) at 31 Mev neutron energy spectra and yields from, 16: 24864
meson (μ^-) reactions, comparison of experiment and predictions of Universal Fermi Interaction, 16: 24788 (NP-11796)
meson (π^+) scattering at 87 Mev, angular distributions, 16: 24720
reactions with gold-197 at 60 to 120 Mev, products from, 16: 24854 (UCRL-9950)
reactions with lithium-6, angular distributions from, 16: 24851
CARBON ISOTOPES C-13
reactions (carbon-13, 4n) with plutonium-241, cross sections for, 16: 24781 (JINR-P-896)
synthesis in early history of solar system, 16: 24658
CARBON ISOTOPES C-14
determination using liquid scintillation counters, 16: 24337
distribution of recoil atoms from nitrogen-14 (n,p) reactions in crystalline solids, 16: 23734
exchange in isocyanate dimerization, 16: 23557
isotope effects in aldehyde reactions, 16: 23577
labeling of organic compounds, 16: 23552
CARBON ISOTOPES C-15
energy level lifetime, first-excited, 16: 24855
CARBON–MOLYBDENUM–URANIUM SYSTEMS
metallurgical properties, 16: 24150 (CNEN-113)
CARBON MONOXIDES
electron diffusion and mobility in, 16: 24281 (NP-11846)
hatchability effects on Habrobracon eggs in first meiotic metaphase, post irradiation, 16: 23452
ionization by metastable helium atoms, cross sections, 16: 24296
reactions with uranium oxides and uranyl fluorides, thermodynamic characteristics of reduction in, 16: 24187
CARBON TETRACHLORIDE
determination in air, polarographic, 16: 23384 (TID-7616(p.211-21))
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
properties as radiopaque penetrant, 16: 23978
solvent properties for mercury, 16: 23591
CARBON–THORIUM–URANIUM SYSTEMS
burnup in reactors, effects of fission products on, 16: 24384
corrosion and oxidation, 16: 24630
criticality studies, 16: 24408
phase studies, 16: 24180(T) (AEC-tr-5175)
CARBON–TUNGSTEN SYSTEMS
phase studies, 16: 24798(R) (WADD-TR-60-143(Pt.III))
CARBON–URANIUM SYSTEMS
neutron resonance capture integrals, high-energy, 16: 24396
CARBON–ZIRCONIUM SYSTEMS
phase studies, 16: 24798(R) (WADD-TR-60-143(Pt.III))
CAROLINAS-VIRGINIA TUBE REACTOR
control system performance, analog computer study, 16: 24972 (CVNA-138)
pressure tube fabrication and testing, 16: 24973 (CVNA-141)
CASCADE SHOWERS
development, computer program for calculation, 16: 24697 (NYO-10132)
CAST IRON
analysis for silicon by fast neutron activation, 16: 24573
CATHODES
photoeffect mechanisms, under x irradiation, 16: 24328
CATION EXCHANGE MATERIALS
reactions with cadmium, lead, and uranyl ions, equilibrium constants, 16: 23534
CATS
nucleic acid antimetabolite effects on nervous system, 16: 23478
CAVES
design of In-Pile Gas-Cooled Fuel Element Test Facility, 16: 24950 (ORNL-TM-250)
development of Transuranium Facility, 16: 23528(R) (ORNL-3290)
for radioisotopes, in Czechoslovakia, 16: 23809
gamma spectrometer development for use inside, 16: 23618 (TID-7629 (p.42-53))
CAVITY RESONATORS
electron bunching in long-gap, 16: 24299
electron load of cyclotron, 16: 24867 (JINR-P-962)
resonance discharge in, effects of magnetostatic fields, 16: 24869(T) (AERE-Trans-890)
variable-frequency, for electron beam bunching, 16: 24875
CELLULOSE
radioinduced graft polymerization of acrylonitrile and styrene on cotton, 16: 23544
CERAMIC COATINGS
development, 16: 24178(R) (WAL-TR-766-3/1-3)
development for protection of tungsten from oxidation, 16: 24122(R) (NP-11700)
CERAMIC MATERIALS
bibliography on diffusion in, 16: 24157 (IS-448)
chemical and physical properties, research progress at Lawrence Radiation Lab., 16: 24175(R) (UCRL-10119)
CERIUM
exchange between dioxide and trifluoride in molten fluoride mixtures, 16: 23595
reduction on mercury cathode, electrolytic, 16: 23578
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
separation from chromium and nickel, 16: 23658
separation from molten fluoride mixtures, 16: 23595
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
CERIUM FLUORIDES
solubility in molten fluoride mixtures, 16: 23595
CERIUM–HYDROGEN SYSTEMS
properties, 16: 23683
CERIUM ISOTOPES Ce-140
neutron photoproduction cross sections, 16: 24778 (CEA-2148)
CERIUM ISOTOPES Ce-141
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
CERIUM ISOTOPES Ce-144
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
neutron capture cross sections and resonance integrals for, 16: 24389
CERIUM OXIDE–URANIUM OXIDE SYSTEMS
properties as reactor fuel, 16: 24625
CESIUM
ion exchange with barium, tracer study, 16: 25048 (TID-7628(p.179-86))
scavenging by ion exchange materials, 16: 25053 (TID-7628(p.237-47))
separation of fission product, radiochemical, 16: 24564
shielding properties, 16: 25031 (JPL-TR-32-232)
sorption on Victorian brown coal, 16: 25033 (AAEC/TM138)
CESIUM FLUORIDE CRYSTALS

nuclear quadrupole coupling constants in, 16: 24654
CESIUM IODIDE CRYSTALS
scintillation response to alphas and protons, 16: 23883
CESIUM ISOTOPES
percolation in soil, effects of physicochemical characteristics of soil, 16: 25050 (TID-7628(p.198-210))
CESIUM ISOTOPES Cs-133
electron-spin-resonance spectra in rare-gas matrices at 4.2°K, 16: 23702
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
CESIUM ISOTOPES Cs-134
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
CESIUM ISOTOPES Cs-136
yields from alpha and deuteron fission of uranium-233, 16: 24351
CESIUM ISOTOPES Cs-137
analysis for impurities, 16: 23631 (TID-7629(p.209-16))
content in drinking water in United Kingdom, 1961, 16: 24033
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
dosimetry studies, 16: 23399
half life, 16: 24566
tracer use in petroleum industry, 16: 24057
use to detect defects in telephone cables, 16: 24062
CESIUM ISOTOPES Cs-141
half life, 16: 24813
CESIUM ISOTOPES Cs-142
half life, 16: 24813
CESIUM ISOTOPES Cs-143
half life, 16: 24813
CHARGED PARTICLE BEAMS
conditions for stabilized relativistic, 16: 24874
CHARGED PARTICLES
detection and measurement by semiconductor detectors, 16: 23870
detection of high-energy, with silver chloride single crystals, 16: 23931
interactions in crystals, potential energies for polarized, 16: 24745
interactions with electromagnetic fields, quantum theory, 16: 24927
reactions with surfaces to measure surface properties, 16: 24568
reactions with surfaces to measure surface properties, 16: 24569
wave function for many-body systems of, in Coulomb potentials, 16: 24755
CHELATES
effectiveness in removal of plutonium and americium from tissues, 16: 23396
CHEMICAL ANALYSIS
conference on bio-assay and, Santa Fe, Oct. 1960, 16: 23372 (TID-7616)
developments in tools for, 16: 23648
CHEMICAL ENGINEERING
use of radioisotopes, 16: 24047
use of radioisotopes in petroleum industry, 16: 24069
CHEMICAL PROPHYLAXIS
of radiation injuries, effects on toxicity of blood serum, 16: 23440
CHEMICALS AND REAGENTS
review of radioreagent techniques, 16: 24575
CHEMISTRY
bibliography and review on developments in high-temperature, 16: 23677
book: *Isotopic Analysis of Waters*, in German, 16: 23661
chemical properties of inorganic materials, research at Lawrence Radiation Lab., 16: 24175(R) (UCRL-10119)
conference on analytical chemistry in nuclear reactor technology, Gatlinburg, Tenn., October 10 to 12,1961, 16: 23613 (TID-7629)
conference on macromolecular, 16: 23540
conference on radioisotopes, 16: 23547
conference on science in the advancement of new states, Rehovoth, Israel, August 1960, German translation, 16: 23361
research on nuclear and solution, 16: 23529(R) (TID-16024)
CHERENKOV DETECTORS
design of focusing, for high-energy physics, 16: 24696 (NP-11880)
design of large-area, 16: 23937
CHERENKOV RADIATION
emission by particles in plasma, anomalous Doppler effect, 16: 24897
CHICKENS
metabolism of radio-sulfate and distribution in chick stomach, 16: 23401
radiation effects, 16: 24044
radiation effects on embryo, 16: 23476
radiation effects on metabolic reactivity, role of nervous system in, 16: 23422(T) (AEC-tr-5190)
CHLORIDE IONS
chlorine exchange with dichlorodiammineplatinum(II), 16: 23681
CHLORINE
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
exchange between chloride ions and dichlorodiammineplatinum(II), 16: 23681
movement in peppermint plant, 16: 23389
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
radioinduced addition to silicone rubbers, 16: 23759
reactions with formic acid, deuterium isotope effects in photochemical, 16: 23567
CHLORINE ISOTOPES Cl-34
yields of metastable, in proton spallation of copper at 24 Bev, 16: 24859
CHLORINE ISOTOPES Cl-35
neutron reactions (n,p) in chlorobenzene, sulfur-35 activity in yields from, 16: 23719(T) (AEC-tr-5093)
neutron reactions (n,p), activation measurements for, 16: 24787 (NP-11793)
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
CHLORINE ISOTOPES Cl-36
determination of cosmic-ray-induced in meteorites, 16: 23984 (NYO-8922)
determination using liquid scintillation counters, 16: 24337
CHLORINE ISOTOPES Cl-38
yields in proton spallation of copper at 24 Bev, 16: 24859
CHLORINE ISOTOPES Cl-39
yields in proton spallation of copper at 24 Bev, 16: 24859
CHLOROFORM
determination in air, polarographic, 16: 23384 (TID-7616(p.211-21))
CHOLESTEROL
preparation of tritium-labeled, by electric discharge, 16: 23548
CHROMATOGRAPHY
equipment, design of radiochromatogram scanner, 16: 23940
gas, ionization detector using strontium-90, 16: 23932
CHROMIUM
determination in biological materials, activation, 16: 23403
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
diffusion in Inconel and Inor-8 alloys under corrosive conditions, 16: 23594
diffusion in steels, effects of carbon content, 16: 24199
neutron capture cross sections, effects of energy, 16: 24810
separation from cerium and nickel, 16: 23658
CHROMIUM BORIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
CHROMIUM CARBIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
CHROMIUM COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
CHROMIUM–COBALT–MOLYBDENUM–NICKEL ALLOYS
mechanical properties, effect of rhenium admixture on, 16: 24200
CHROMIUM–COBALT–NICKEL–TUNGSTEN ALLOYS
corrosion by decontaminating solution, 16: 24496
CHROMIUM COMPLEXES
photoracemization of potassium trioxalatochromiumate, 16: 23686
reactions, tracer studies, 16: 23581
CHROMIUM–COPPER–IRON–MOLYBDENUM–NICKEL ALLOYS

corrosion and metallurgical changes by steam at 1200 to 1500°F, 16: 24126
CHROMIUM–IRON–MANGANESE–MOLYBDENUM–NICKEL–SILICON SYSTEMS
corrosion and metallurgical changes by steam at 1200 to 1500°F, 16: 24126
CHROMIUM–IRON–MANGANESE–MOLYBDENUM–NICKEL–TUNGSTEN ALLOYS
corrosion and metallurgical changes by steam at 1200 to 1500°F, 16: 24126
CHROMIUM–IRON–MOLYBDENUM–NICKEL ALLOYS
corrosion by chloride solutions, 16: 23528(R) (ORNL-3290)
diffusion of chromium in Inor-8 under corrosive conditions, 16: 23594
oxidation of Hastelloy X at 900 to 1100°C, 16: 24124(T) (AEC-tr-5235)
CHROMIUM–IRON–NICKEL ALLOYS
corrosion and metallurgical changes by steam at 1200 to 1500°F, 16: 24126
corrosion by decontaminating solution, 16: 24496
diffusion of chromium in Inconel under corrosive conditions, 16: 23594
mechanical properties of forged bar, sheet and plate, 16: 24151 (DC-61-2-133)
oxidation of Nicral D at 900 to 1100°C, 16: 24124(T) (AEC-tr-5235)
CHROMIUM ISOTOPES Cr-48
yields in proton spallation of copper at 24 Bev, 16: 24859
CHROMIUM ISOTOPES Cr-49
yields in proton spallation of copper at 24 Bev, 16: 24859
CHROMIUM ISOTOPES Cr-51
electron capture decay, L/K capture ratio, 16: 24844
separation from water by adsorption on minerals, 16: 25035 (HW-69225)
tracer use in measurement of sedimentation drift, 16: 24001
tracer use in measuring quartz sand drift, 16: 23995
yields in proton spallation of copper at 24 Bev, 16: 24859
CHROMIUM ISOTOPES Cr-52
neutron reactions, cross section resonances, 16: 24818
neutron reactions (n,p), activation measurements for, 16: 24787 (NP-11793)
CHROMIUM–NICKEL STEEL
corrosion by acids at high temperature, 16: 24129
CHROMIUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
CHROMIUM OXIDE–SILICON OXIDE SYSTEMS
phase studies, 16: 24148(R) (ASD-TR-61-676)
CHROMIUM–SILICON COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
CHROMOSOMES
radioinduced aberrations in plants, factors affecting, 16: 23451
radioinduced breakage *in vivo* and *in vitro*, 16: 23465
CIRCUITS
design of logarithmic attenuator for multiplying voltage pulses, 16: 23917
for canceling background gamma radiation in Hornyak buttons, 16: 23916 (UAC-609-2)
for pulse shape discrimination in junction detectors, 16: 23901 (PUC-1962-69)
for pulsed shape discrimination in scintillation detectors, 16: 23913
CIVILIAN DEFENSE
book: *Nuclear War and Nuclear War Protection*, 16: 24032(T)
training course, 16: 24653
CLAYS
reactions with strontium, tracer studies, 16: 25049 (TID-7628(p.187-97))
CLINCH RIVER
calcium, strontium, and strontium-90 content in clams in, 16: 23410 (ORNL-TM-270)
COAL
particle separation from water-fluidized, tracer techniques in, 16: 24035(R) (NYO-9851)
sorptive properties of Victorian brown, for cesium and strontium in water, 16: 25033 (AAEC/TM138)
COBALT
determination in biological materials, activation, 16: 23403
determination in iron, activation, 16: 23649
determination in niobium and zirconium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
movement in peppermint plant, 16: 23389
neutron absorption, resonance scattering effects on, 16: 24433
separation from aqueous solutions by mixer-settlers, review, 16: 23793
surface friction in sliding on cobalt, effects of surface films, 16: 23800 (R60GL185)
COBALT ALLOYS
corrosion by decontaminating solution, 16: 24496
testing for use as EGCR through-tube bearing material, 16: 24170 (ORNL-TM-249)
COBALT BORIDES
electronic structure, 16: 23662 (AE-76)
COBALT(II) CHLORIDES
additive effects on spin-lattice relaxation in glycerine-titanium chloride solutions, 16: 23703
COBALT COMPLEXES
decomposition of bromo-, effects of bromine-80m isomeric transitions in, 16: 23764
reactions, tracer studies, 16: 23581
COBALT(III) COMPLEXES
ligand exchange kinetics of carbonato-amine, 16: 23685
photochemistry, 16: 23686
COBALT IONS
separation of ferric ions from, by anion exchange, 16: 24081
COBALT ISOTOPES Co-55
yields in proton spallation of copper at 24 Bev, 16: 24859
COBALT ISOTOPES Co-56
yields in proton spallation of copper at 24 Bev, 16: 24859
COBALT ISOTOPES Co-57
yields in proton spallation of copper at 24 Bev, 16: 24859
COBALT ISOTOPES Co-58
yields in proton spallation of copper at 24 Bev, 16: 24859
COBALT ISOTOPES Co-60
dosimetry studies, 16: 23399
gamma emission, 16: 24583
tracer use for measurement of sand drift on Japanese coasts, 16: 24003
tracer use in petroleum industry, 16: 24057
use in purification of used waters, 16: 24054
use to detect defects in telephone cables, 16: 24062
COBALT ISOTOPES Co-61
yields in proton spallation of copper at 24 Bev, 16: 24859
COBALT MOLYBDATES
catalytic effects in hydrocracking to reclaim organic coolants, 16: 25018(R) (IDO-16761(p.1-74))
COBALT–MOLYBDENUM–NICKEL ALLOYS
properties of MAR-Aging steels, 16: 24153 (DMIC-Memo-156)
COBALT–NICKEL ALLOYS
self-diffusivities in, 16: 24169 (NYO-9430)
COBALT–TUNGSTEN CARBIDE SYSTEMS
elasticity, Young's modulus, 16: 24176 (WADD-TR-60-749(Pt.II))
COLD NEUTRONS
scattering by crystals, relation between cross sections and oscillation frequencies, 16: 24767(T) (AEC-tr-5156)
COLLIMATORS
efficiency, computer program for evaluation, 16: 24905 (NAA-SR-Memo-7347)
COMMUNICATION SYSTEMS
atomic explosion effects on, high-altitude, 16: 23994
COMPRESSIBLE FLOW
velocity distribution of viscous vortex, tangential, 16: 23818 (JPL-TR-32-290)
COMPUTER PROGRAMS
AMOK, for thermal neutron spectra, 16: 24367
APWRC subroutines for preparing program and cross-section library tapes for IBM-7090, 16: 24094 (MND-C-2500-6)
ARES, for neutron absorption resonance integrals, 16: 24391
CHIC, for reactor thermal analysis, 16: 24442

COLLOREK, for reactor kinetics calculations, 16: 24541
CONEC for IBM-7090, for fast burst analysis of bare assemblies, 16: 24438
COST for IBM-704, for fast reactor fuel cycle analysis, 16: 24437
CRCC, for control rod effects on neutron flux, 16: 24930 (AE-75)
CYCLE for IBM-704, for fast reactor fuel cycle analysis, 16: 24437
D-space for crystal studies on CDC-1604 and IBM-704, 16: 23527 (ANL-6519)
FAD for IBM-704, for fuel assembly designs, 16: 24435
for analysis of bubble chamber film data on IBM-709, 16: 23851 (UCRL-10109)
for analysis of steady fluid flow in soils, IBM 7090, 16: 25045 (TID-7628(p.130-44))
for calculating Dirac traces in quantum electrodynamics, 16: 24922
for calculation of Fermi-levels in non-metals on IBM 7090, 16: 24158 (K-1526)
for calculation of gamma heating in reactors, 16: 24287 (UCRL-6891)
for calculation of burnup effects and thermal constants for Belgian Reactor-2, 16: 25013 (BLG-69)
for digital approximation of differential equations using trapezoidal convolution, 16: 24652
for Monte Carlo calculations of nuclear cascades, 16: 24697 (NYO-10132)
for preparation and reporting of routine radiochemical plutonium analysis, 16: 23630 (TID-7629(p.193-208))
for rational approximation of decay-type functions, 16: 24086 (ARL-229)
for reactor burnup studies, 16: 24942 (KR-20)
Fortran for IBM 704-7090, for solving neutron multigroup diffusion equations, 16: 24763 (TRG-Report-229)
Fortran, for single crystal absorption corrections, 16: 24095 (ORNL-TM-229)
GAM-1 data tape, nuclear data for, 16: 24088 (GA-2451(Vol.II))
GAMICO for calculation of neutron slowing-down spectrum on IBM 7090, 16: 24945 (MND-C-2500-5)
GATHER-II for IBM-7090, for neutron spectra, 16: 24440
GE-NMPO program 484 auxiliary for neutron scattering, 16: 24090 (GEMP-116)
GE-NMPO 482, calculation of total macroscopic cross sections for IBM 7090, 16: 24089 (GEMP-114)
GE-NMPO 485 auxiliary 20-6, for nuclear excitation and transition probabilities, 16: 24091 (GEMP-117)
GR-1 for calculation of penetration of point monodirectional gamma rays through slab shields, 16: 24907 (WAPD-T-1464)
HACE for Monte Carlo evaluation of fast neutron collimators on IBM-7090, 16: 24905 (NAA-SR-Memo-7347)
HINX for transcription of MUFT and KATE output data to KARE input cards, 16: 24093 (KAPL-M-RPC-4)
MUFT-R, solution of fast neutron transport problems for IBM-650, 16: 24092 (IDO-16735)
ODD for one-dimensional multigroup reactor analysis on IBM-704, 16: 24935 (DC-61-2-97)
QUICKIE for IBM-7090, for neutron diffusion, 16: 24436
SNYFAR-02 for static and dynamic synthesis of two-dimensional flux and reactivity on IBM 7090, 16: 24943 (MND-C-2500-3)
SYBURN for synthesized two-dimensional burnup calculations on IBM 7090, 16: 24944 (MND-C-2500-4)
ULCER for IBM-7090, for neutron diffusion, 16: 24436
2D PERT for IBM-704, for reactor reactivity analysis, 16: 24441
20-2 for approximating cross section dependence on energy on IBM 7090, 16: 24678 (GEMP-113)
20-4 for averaging differential scattering cross sections on IBM-7090, 16: 24679 (GEMP-115)

COMPUTERS

coding for calculation of in-pile radioinduced heating, 16: 24240 (NARF-61-40T)
operation and uses in bubble chamber picture analysis, 16: 24087 (BNL-725)
use in data reduction in activation analysis, 16: 23632 (TID-7629 (p.221-38))
use in scheduling system for a power reactor, 16: 24545
uses in reactor fueling studies, 16: 24932 (CRRP-1087)

CONCRETE AGGREGATES

composition and properties of iron-bearing, 16: 24226
composition and properties of hydrous-iron, 16: 24227
preparation and properties of heavy steel-, for shielding, 16: 24228
shielding properties, 16: 24224

CONCRETES

book: *Concrete for Radiation Shielding*, 16: 24220 (NP-11837)
construction inside reactor containment vessels, 16: 24232
gamma and x-ray absorption by, 16: 24223
gamma-ray differential dose albedo in, semi-empirical formula, 16: 24599
gamma-ray reflection and transmission in, Monte Carlo calculations, 16: 24598
gamma scattering, 16: 24911
neutron attenuation in, fast, 16: 24225
neutron attenuation in, effects of composition, 16: 24908
preparation and properties for radiation shielding, 16: 24222
preparation and properties of high-density ilmenite, for shielding, 16: 24225
shielding properties, 16: 24221
shielding properties, gamma and neutron, 16: 24224

CONFERENCES

Bio-assay and Analytical Chemistry, Sixth Annual Meeting, Santa Fe, Oct. 1960, 16: 23372 (TID-7616)
description of Symposium on the Thermodynamics of Nuclear Materials, Vienna, May 21 to 25, 1962, 16: 23694
Fifth Conference on Analytical Chemistry in Nuclear Reactor Technology, Gatlinburg, Tenn., October 10 to 12, 1961, 16: 23613 (TID-7629)
Fourth Japan Conference on Radioisotopes, October 1961, Abstracts and Program, 16: 23354 (NP-11767)
Ground Disposal of Radioactive Wastes, Chalk River, Canada, 1961, 16: 25037 (TID-7628)
International Symposium on Macromolecular Chemistry, Moscow, June 14 to 18, 1960, 16: 23540
Lind Jubilee Symposium on the Development of Radiation Chemistry, 16: 23711 (JLI-650-2-1(Vol.II))
Proceedings of the Eighth Scintillation Counter Symposium, Washington, D. C., March 1 to 3, 1962, 16: 23876
Radioisotopes in the Physical Sciences and Industry, Vol. III, Copenhagen, Sept. 6 to 17, 1960, 16: 23547
Response of the Nervous System to Ionizing Radiation, Chicago, Sept. 7-9, 1960, 16: 23471
Science in the Advancement of New States, Rehovoth, Israel, August 1960, German translation, 16: 23361
Second Symposium on Physics and Nondestructive Testing, Argonne, Ill., Oct. 1961, 16: 23963 (ANL-6515)
summary of Symposium on Reactor Safety and Hazards Evaluation Techniques, Vienna, May 14 to 18, 1962, 16: 24027
summary of Symposium on Radiation Damage in Solids and Reactor Materials, Venice, May 7 to 11, 1962, 16: 24251
summary of Symposium on Use of Radioisotopes in Soil-Plant Nutrition Studies, Bombay, Feb. 26 to March 2, 1962, 16: 23392
transactions of the American Nuclear Society 1962 Meeting, Boston, 16: 24338

CONVECTION (FREE)

flow and stability problems in multiple-channel systems, 16: 24506
heat transfer to fluid in vertical tubes, 16: 23824

CONVERSION ELECTRONS

polarization following beta decay of internal, 16: 24784 (NP-11622)

COPPER

analysis for arsenic, radioisotope methodology in, 16: 24565
determination in biological materials, activation, 16: 23403
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
electron transport at 0.4 to 4.0 Mev, Monte Carlo calculation of, 16: 24746
exploding wire phenomena, shock waves from, 16: 24273 (BRL-1152)
mesic atoms of, meson (μ^-) decay in, 16: 24278 (JINR-P-971)
neutron activation, reactor spectra measurements by, 16: 24904 (DC-61-2-98)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)

proton spallation at 24 Bev, yields from, 16: 24859
radiation effects below 1 Mev, electron, 16: 24260
radiation effects on modulus of elasticity after cold working, 16: 24261
separation from uranium acid leach solutions by ion exchange and precipitation, 16: 23771 (ACCO-24)
work hardening, analysis by nuclear magnetic resonance method, 16: 24214

COPPER ALLOYS
analysis for arsenic, radioisotope methodology in, 16: 24565

COPPER–GOLD ALLOYS
x-ray scattering, effects of long-range order, 16: 24212

COPPER ISOTOPES Cu-61
yields in proton spallation of copper at 24 Bev, 16: 24859

COPPER ISOTOPES Cu-63
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
proton reactions (p,n), cross sections at 10 Mev, 16: 24793 (TID-12696)

COPPER ISOTOPES Cu-64
production of carrier-free, electrolytic, 16: 24083
yields in proton spallation of copper at 24 Bev, 16: 24859

COPPER ISOTOPES Cu-65
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
proton reactions (p,n), cross sections at 10 Mev, 16: 24793 (TID-12696)

COPPER–ZINC ALLOYS
x-ray scattering, effects of long-range order, 16: 24212

CORROSION
book: *Corrosion and Protection of Metal Construction Materials*, 16: 24129
inhibition, use of radioisotopes in studies, 16: 23593

CORTICOSTEROIDS
radiation effects on adrenal secretion, in adrenal transplants in rat, 16: 23417(R) (TID-16122)

COSMIC ALPHA PARTICLES
energy spectra and fluxes, high-altitude emulsion measurements during 1959 to 1961, 16: 24660(R) (AROD-2774:2)

COSMIC ELECTRONS
shielding for inner and outer belt, 16: 24910

COSMIC MESONS (μ)
charge ratio at sea level, 16: 24669
intensity at 40 mwe, corrections for atmospheric effects, 16: 24670

COSMIC NEUTRONS
intensity variations during IGY, Forbush type, 16: 24673

COSMIC PARTICLES
acceleration in outer atmosphere, theory, 16: 24671
detection of high-energy, with silver chloride single crystals, 16: 23931
effects of heavy primary, on eyes, 16: 23428 (BNL-6081)
measurements on balloon flight, 16: 23925
reactions of secondaries with nuclei in photographic emulsions, 16: 24662 (PAN-291/VI)

COSMIC PROTONS
detection and measurement in interplanetary space and Van Allen radiation belt, 16: 23832 (AD-269867)
earth impact zones at 0.05 to 50 Bev, 16: 24661 (NASA-TN-D-1291)
reactions with aluminum shielding, gamma dose from, 16: 24591
shielding for inner belt, 16: 24910

COSMIC RADIATION
dosimetry of energetic galactic and solar, data survey on, 16: 24013 (NASA-TN-D-1267)
energy spectra and fluxes, high-altitude emulsion measurements during 1959 to 1961, 16: 24660(R) (AROD-2774:2)
hazards in space conquest, biological and medical aspects of, 16: 23432
intensity correlation with multiple sclerosis incidence, 16: 23479
intensity increases during sunspot minimum, 1953, 16: 24666
intensity, magnetic field effects on, 16: 24664
intensity variations in last million years, use of iron meteorites in establishing, 16: 24672
intensity variations during IGY, Forbush type, 16: 24673
measurements during Nov. 1960, 16: 24306
shielding against, electrostatic, 16: 24903 (ASD-TDR-62-244)
variations during geomagnetic storms, 16: 24307
variations, during solar events, 16: 24667
variations in solar system, spatial, 16: 24668

COSMIC-RAY SPECTROMETERS
design for telemetering gamma spectra from high altitudes, 16: 23923 (UAC-6125)
design of particle spectrometers for satellites and space probes, 16: 23922

COSMIC SHOWERS
isotropy of extensive, at 10^{13} to 10^{18} ev, 16: 24665

COWBOY PROJECT
elastic wave radiation from spherical cavities formed in salt in, 16: 23804 (RM-3105-AEC)

CREATINE
synthesis in liver, effects of whole-body irradiation, 16: 23463

CRITICAL ASSEMBLIES
critical behavior of unreflected unmoderated enriched molybdenum–uranium, super-prompt, 16: 24540
critical mass calculations for multi-spectrum, 16: 24406
criticality studies of void-containing, 16: 24420
neutron burst characteristics of bare, CONEC code for analyzing, 16: 24438
neutron flux distribution in cavity containing, 16: 24428
neutron flux time-dependent behavior in unmoderated, unreflected cylindrical, 16: 24674 (ORNL-TM-230)
neutron importance in mixed-spectra, 16: 24418
neutron statistical behavior in, 16: 24775
nuclear property measurements in, reliability of, 16: 24353

CRITICALITY STUDIES
comparison of critical and subcritical, 16: 24354

CROSS SECTIONS
averaging over specified energy groups for calculation on angular distributions, computer program for, 16: 24679 (GEMP-115)
energy dependence, computer program for approximating, 16: 24678 (GEMP-113)

CRYSTAL STRUCTURE
distribution functions of disoriented "mosaic" regions, 16: 24330
exciton Bose-Einstein excitation, 16: 24320

CRYSTALS
analysis, computer program for, 16: 23527 (ANL-6519)
charged-particle interactions in, potential energies for polarized, 16: 24745
diffusion coefficients at various temperatures by continuous process by method of radioactive surfaces, 16: 23704
electron energy levels and radiation of atoms in 5 cubic and 27 non-cubic symmetry classes, 16: 24290(T) (UCRL-Trans-399(L))
energy levels in non-metal, computer program for calculation of Fermi, 16: 24158 (K-1526)
evolution equation for homogeneous, 16: 24314
neutron scattering, relation between cross sections and oscillation frequencies, 16: 24767(T) (AEC-tr-5156)
neutron spectra in heavy, thermal, 16: 24377
radiation damage by high-energy particles, statistical theory, 16: 24256
vacancy introduction into, at high concentrations, 16: 24309
x-ray scattering by distorted-fcc binary alloys, effects of long-range order, 16: 24212
x-ray scattering by pairs of disoriented regions, 16: 24330

CURIUM
determination in urine by electrodeposition, 16: 23374 (TID-7616 (p.39-50))
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
separation from berkelium, californium, and einsteinium by phosphonate extraction, 16: 24345
separation from plutonium process waste, 16: 24343

CUTTING TOOLS
wear of die and punch for punching sheet metal, 16: 24068

CYANIDE COMPLEXES
structure of $K_4Mn(CN)_6NO$, 16: 23570

CYCLOBUTENE, HEXAFLUORO-
flame properties, 16: 23536

1,3-CYCLOHEXADIENE
reactions with recoil tritium, 16: 23549

1,4-CYCLOHEXADIENE
reactions with recoil tritium, 16: 23549
CYCLOHEXANE
reactions with recoil tritium, 16: 23549
CYCLOHEXANE, METHYL-
reactions with polar compounds to form complexes, 16: 23533
reactions with recoil tritium, 16: 23549
CYCLOHEXANOL
reactions with recoil tritium, 16: 23549
CYCLOHEXENE
reactions with recoil tritium, 16: 23549
CYCLOHEXYLAMINE
reactions with recoil tritium, 16: 23549
CYCLONE SEPARATORS
performance in particle separation from fluidized coal, tracer techniques in, 16: 24035(R) (NYO-9851)
CYCLOPENTANE
radiolysis, 16: 23587
CYCLOPROPANE
electron diffusion in, at low energies, 16: 24325
CYCLOTRONS
beam focusing with sectioned magnet system, 16: 24876
particle orbit design for, with spatial magnetic variation, 16: 24878
resonator electron load, 16: 24867 (JINR-P-962)
CYLINDERS
neutron absorption in composite, 16: 24760 (CRT-1079)
sound propagation in solid, 16: 23972 (ANL-6515(p.133-61))
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
CYSTEIC ACID
preparation of sulfur-35-labeled, 16: 23561
CYSTEINE
preparation of sulfur-35-labeled, 16: 23561
CZECHOSLOVAKIA
radioisotope laboratories, 16: 23809

D

DAREX PROCESS
effects of burnup on, 16: 24644
DATA RECORDING SYSTEMS
question principles of plotting system for use with punched tape, 16: 23943 (CREL-1009)
DECANE
solvent properties for mercury, 16: 23591
DECONTAMINATING SOLUTIONS
corrosive effects on reactor materials, 16: 24496
DECONTAMINATION
equipment development for, 16: 24009 (CRRIS-1071)
of reactors by single-solution chemical treatment, 16: 24496
procedure for D140 E power plant, 16: 24976 (DC-60-10-726)
DEHYDROGENASES
radiation effects on glutamic, protective effects of mitochondria against, 16: 23456
DENSITOMETERS
bibliography on radiometric, 16: 23982 (AERE-Bib-140)
DENSITY
measurement, calibration curves for density-gradient columns, 16: 23938
measurement in liquids with radioisotopes, 16: 24069
measurement of soil, bibliography on nuclear methods for, 16: 23982 (AERE-Bib-140)
DETONATION WAVES
effects on communication systems, 16: 23994
DEUTERIUM
biological effects on bacteria, 16: 23388
biological effects on bacteria, 16: 23404
deuteron reactions (d,np) at 8 to 11 Mev, neutron spectra, 16: 24821
electron diffusion and mobility in, 16: 24281 (NP-11846)
exchange with carbonato-amine cobalt(III) complex ions, 16: 23685
isotope effects in photochemical reaction of formic acid with bromine and chlorine, 16: 23567
isotope effects on vibrational force field of ethane, 16: 24300
isotope effects on Claisen rearrangement of allyl *p*-tolyl ether, 16: 23535
synthesis in early history of solar system, 16: 24658
DEUTERON BEAMS
use in producing laminar lesions in brain study, 16: 23490
DEUTERONS
attenuation by stainless steel at 2 Mev, 16: 23964 (ANL-6515(p.9-27))
bioelectric effects on frog sciatic nerve at high energy, 16: 23486 (UCRL-9799)
biological effects on eye, 16: 23428 (BNL-6081)
fission reactions with heavy nuclei, energetics of, 16: 24350
interactions with mesons (K^+) in I = 0 state, charge-exchange, 16: 24727
interactions with photons, disintegration Landau-curve anodes for, 16: 24738
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
production in (p,d) reactions on nuclei far above 1 Bev, 16: 24843
reactions (d,αp) and (d,p) with aluminum-27 at 2.2 to 12.6 Mev, excitation functions for, 16: 24785 (NP-11748)
reactions (d,α) with beryllium-9, spectral measurements from, 16: 23934
scattering and stripping reactions on nitrogen-14 at 27 Mev, 16: 24831
DIET
barium and strontium content in human, 16: 23370 (AERE-R-4035)
DIFFERENTIAL EQUATIONS
digital approximation using trapezoidal convolution, 16: 24652
DIFFUSION
in ceramic systems, bibliography, 16: 24157 (IS-448)
in liquid, neutron scattering studies of, 16: 24271 (AERE-R-4043)
theory of electrons and ion, in neutral gas, 16: 24272 (APED-3959)
DODECYLAMINE
solvent properties for rare earths and transuranic elements, 16: 24344
DOGS
antimony-124 distribution and excretion in, 16: 23386 (UR-608)
blast effects on, in group shelters, 16: 24017 (WT-798)
exposures to plutonium oxide in field and laboratory experiments, enigma, 16: 23381 (TID-7616(p.127-32))
radiation effects, partial and whole-body, 16: 23419 (UR-609)
vitamin B_{12} content and retention in liver, cobalt-60 labeled, 16: 23397 (BNL-4888)
DROPS
deformation energies of charged, discontinuous behavior, 16: 24803
DROSOPHILA
radiosensitivity of immature germ cells, effects of oxygen on, 16: 23470
DRUGS
radiosterilization, 16: 24052
radiosterilization of cacarboxylase hydrochloride, 16: 23424
synthesis of radioprotective analogs of 2-aminoethanethiols, 16: 23515(R) (AD-269983)
DUSTS
fall-out monitoring in Germany, 1956 to 1960, 16: 24006
DYES
diagnostic uses of iodine-131-labeled Rose Bengal for hepatic vesicular affections, 16: 23371 (CEA-1994)
radiosynthesis of indaminic, 16: 23708 (CEA-1991)
DYSPROSIUM
burnup in reactors, 16: 24486
DYSPROSIUM ISOTOPES Dy^{158}
neutron reactions, radioactivity of terbium fraction from, 16: 24814

E

EARTH
age estimation, radiometric, 16: 24007
EGGS
hatchability of Habrobracon, post-irradiation effects of carbon monoxide and nitrogen on, 16: 23452 (BNL-4981)
EINSTEINIUM
separation from americium and curium by phosphonate extraction, 16: 24345
ELASTICITY
measurement of thermal, furnace design for, 16: 24176 (WADD-TR-60-749(Pt.II))

ELECTRIC ARCS
photography, smear camera design for, 16: 23936
ELECTRIC CONDUCTIVITY
measurement in gases at method for high temperature, 16: 24282 (NP-11906)
ELECTRIC DISCHARGE
brightness of spark discharge channel in argon and xenon, 16: 24289(T) (NP-tr-898)
design of gas discharge apparatus, 16: 23815(P)
ELECTROCHEMICAL ANALYSIS
survey, 1956 to 1961, 16: 23671 (NRL-5775)
ELECTROCHEMISTRY
theories of reaction mechanisms, 1956 to 1961 survey, 16: 23671 (NRL-5775)
ELECTRODES
measurement techniques for, 1956 to 1961 survey, 16: 23671 (NRL-5775)
ELECTRODYNAMICS
spinning particle analysis in, effects of Thomas precession, 16: 24925
ELECTROLYSIS
adsorption theory for radioisotope production, 16: 24080
ELECTROLYTIC CELLS
current efficiency of aluminium-processing, 16: 23812
ELECTROMAGNETIC FIELDS
diffusion in stationary conducting medium, 16: 23834 (AERE-M-1014)
interactions with plasma, conductivity decay measurements in, 16: 24881 (AFCRL-1119)
interactions with charged particles and magnetic monopoles, quantum theory, 16: 24927
ELECTROMAGNETIC WAVES
diffraction by conducting plate in conducting media, 16: 24713
interactions with electron beams of plane, in magnetic fields, 16: 24308
propagation in plasma, nonlinear kinetics of, 16: 24899
ELECTRON BEAMS
bunching in long-gap cavity, 16: 24299
bunching, variable-frequency device for, 16: 24875
interaction with ion streams, compensation of ion space charge by, 16: 24288(T) (FTD-TT-62-317)
interactions with plane electromagnetic waves in magnetic fields, 16: 24308
interactions with plasma, anomalous Doppler effect in Cherenkov radiation, 16: 24897
loading, effects of klystron gaps, 16: 24298
production in linear accelerators, 16: 23976 (ANL-6515(p.218-47))
use of fast cyclotron wave of magnetically focused, for frequency multiplication, 16: 24297
ELECTRON CAMERAS
design of electron-bombardment-induced-conductivity tubes for, 16: 23853 (WADD-TN-60-307)
ELECTRON MULTIPLIER TUBES
design and performance with continuous strip surfaces, 16: 23890
performance of transmission dynode for high-speed counting of particles, 16: 23889
ELECTRON TUBES
design and target material selection for electron-bombardment-induced-conductivity, 16: 23853 (WADD-TN-60-307)
effects of klystron gap on electron beam loading, 16: 24298
electron bunching in long-gap cavity, 16: 24299
ELECTRONIC EQUIPMENT
radiation effects on, bibliography on, 16: 24241 (NP-11852)
testing with light pulsers for nuclear physics experiments, 16: 23918 (UCRL-9982)
ELECTRONIC FILTERS
design for precipitation of radioactive aerosols, 16: 24021(T) (CEA-tr-A-1002)
ELECTRONICS
survey of nanosecond techniques, 16: 23912
ELECTRONS
acceleration in annular synchrocyclotron, 16: 24866 (JINR-P-914)
anisotropies and drift velocities in n-type germanium crystals, 16: 24323
antineutrino scattering, two-body approximation of elastic, 16: 24688 (JINR-P-947)
attenuation by aluminum, carbon, and copper at 0.4 to 4.0 Mev, Monte Carlo calculation of, 16: 24746
cross sections for inelastic collisions with ions, calculation methods, 16: 24285(R) (TID-16127)
diffusion and mobility coefficients in gases, 16: 24281 (NP-11846)
diffusion in gases at low energies, 16: 24325
diffusion in neutral gas, theory, 16: 24272 (APED-3959)
diffusion in scattering gas, 16: 24676 (APED-3960)
Dirac theory of, Foldy-Wouthuysen transformation relation to Lorentz transformation in, 16: 24736
emission and scattering by magnesium oxide, 16: 24335
interactions in solids, relation to galvanomagnetic effects in, 16: 24319
interactions with protons at high energies, meson (π) production in, 16: 24707
interactions with protons, theory of bremsstrahlung and pion production processes, 16: 24709
load and oscillations in cyclotron resonators, 16: 24867 (JINR-P-962)
losses in transient plasma, measurements by microwave cavity method, 16: 24881 (AFCRL-1119)
motions of Bloch, in magnetic fields, 16: 24318
neutrino scattering, two-body approximation of elastic, 16: 24688 (JINR-P-947)
photoproduction of e-μ pairs on nuclei at high energies, forbidden, 16: 24724
radiation Compton scattering by polarized, cross section for unpolarized, 16: 24922
reactions with lattice of alkali halide crystals, constants for hyperfine F-center, 16: 24316
reactions with nuclei in alkali halide crystals, double-resonance spectrum for hyperfine F-center, 16: 24317
scattering by nuclei, form factors for elastic and inelastic, 16: 24862
scattering by nuclei, positron annihilation reactions in, 16: 24863
ELECTROSTATIC FIELDS
properties as shielding against cosmic radiation, 16: 24903 (ASD-TDR-62-244)
ELEMENTARY PARTICLES
Feynman diagrams of, equations for surface of proper singularities, 16: 24683 (JINR-P-889)
interactions at low energies, gauge principle in nonleptonic, 16: 24741
interactions, conservation of axial vector current in weak, 16: 24728
interactions, field theoretical model for strong, 16: 24726
interactions, gauge invariance theory, 16: 24694 (NP-11731)
interactions in plasma, spatial correlations for, 16: 24898
interactions, properties of long-range scalar, 16: 24753 (PUC-1962-58)
interactions, radius lower limit calculation for, 16: 24740
interactions, Yang-Mills field theory for, 16: 24729
interactions, 3-body Green's function for S-states in potential, 16: 24731
model for, with bound-state fermions as mesons, 16: 24722
model, using statistical quantum theory for free space, 16: 24920
potential scattering, with complex angular momentum and energy, 16: 24310
properties of virtual, 16: 24752 (UCRL-9993)
reactions at high energies, research progress, 16: 24699(R) (TID-15820)
scalar, Newton-Wigner coordinate for, 16: 24686 (JINR-P-939)
scattering equation, formulation of nonlinear singular integral Low, 16: 24913 (JINR-P-890)
scattering equation, operators connected with nonlinear singular integral Low, 16: 24914 (JINR-P-901)
scattering theory, unitarity, crossing symmetry, and complex poles in low energy, 16: 24912 (AD-270903)
spin, hypercharge and degeneracy in respect to, 16: 24681 (JINR-D-976)
symmetry properties of S-matrix with application to resonance reactions, 16: 24916 (NP-11738)
theory, photron concept, 16: 24714
transport coefficients, microscopic determination, 16: 24921
ELEMENTS
absorption coefficients, neutron and x-ray, 16: 23966 (ANL-6515 (p.53-80))
bibliography on chemistry and physics, 16: 23784 (ORNL-2971(Vol.1))
production of transactinide and transcurium, 16: 24339
sorption by ion exchange materials, 16: 23580
EMBRYOS

radiation effects, 16: 23472
radiation effects on neural tube, 16: 23476
radiation effects on development of hamster, ova exposure, 16: 23416 (TID-16121)
radioinduced lethality in grasshopper, relative biological effectiveness of 14 Mev neutrons and 200 kvp x rays for, 16: 23413 (TID-15962)
ENZYMES
action mechanism of isocitratase, 16: 23390
radiosterilization of cacarboxylase hydrochloride, 16: 23424
EQUIPMENT AND PROCEDURES
development for use of wet hydrogen as sintering atmosphere, 16: 24102(R) (EURAEC-57(App.5))
developments for analytical chemistry, 16: 23648
ERBIUM
reduction on mercury cathode, electrolytic, 16: 23578
ERBIUM ISOTOPES Er-167
neutron resonance Doppler broadening in, 16: 24393
ERYTHROCYTES
binding of mercury by, tracer study, 16: 23393
sensitization measurements, tracer method, 16: 23435
ESCHERICHIA COLI
radiation effects of ultraviolet, effects of dinitrophenol, 16: 23449
radiation effects, post-irradiation effects of nutritional substances, 16: 23457
radiosensitivity, effects of physical conditions, 16: 23426
ESTRADIOL
effects on metabolism in tumor tissue, 16: 23367
ETHANE
vibrational force field, deuterium isotope effect, 16: 24300
ETHANE, HEXABROMO-
fate of bromine-82 atoms produced by bromine-81 (n,γ) reactions in, 16: 23733
ETHANETHIOLS, 2-AMINO-
synthesis of radioprotective analogs, 16: 23515(R) (AD-269983)
ETHANOL
dehydration kinetics, 16: 23568
ETHER, BIS(2-CHLOROETHYL)
solvent properties for gallium(III) and indium(III) ions from acid solutions, 16: 23582
ETHERS
Claisen rearrangement of allyl *p*-tolyl ether, solvent and deuterium isotope effects, 16: 23535
ETHYLENE
electron diffusion in, at low energies, 16: 24325
radioinduced polymerization with acrylonitrile in toluene, 16: 23762
radioinduced polymerization, 16: 23352(R) (BNL-705)
radiolysis, absolute hydrogen yields in gamma, 16: 23730
ETHYLENE, CHLORO- POLYMERS
diffusion of argon and helium in, radiation effects, 16: 24268
radioinduced graft polymerization of acrylonitrile on, 16: 23541
ETHYLENE, CHLOROTRIFLUORO-
flame properties, 16: 23536
ETHYLENE, 1,2-DICHLORO-1,2-DIFLUORO-
flame properties, 16: 23536
ETHYLENE, DIFLUORO-
flame properties, 16: 23536
ETHYLENE GLYCOL POLYMER ETHERS
preparation of tritium-labeled, by electric discharge, 16: 23551
ETHYLENE OXIDE
preparation of tritium-labeled, by electric discharge, 16: 23551
ETHYLENE POLYMERS
diffusion of argon and helium in, radiation effects, 16: 24268
neutron (π^-) reactions at 75 Mev, charge-exchange in, 16: 24689 (JINR-P-948)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
radiation effects on dielectric properties, 16: 24248
radiation effects on thermal stability of fibers, 16: 24255
radiation effects on mechanical properties of rolled films, 16: 24259
radioinduced crosslinking, localized neutron, 16: 23720(T) (AEC-tr-5144)
radioinduced crosslinking, free radicals, 16: 23542
radioinduced graft polymerization of methacrylic acid on fibers, effects on dyeing properties, 16: 24265
radioinduced graft polymerization with acrylonitrile and styrene, 16: 23718(T) (AEC-tr-4321)
radioinduced heating in Ground Test Reactor, comparison with computer code results, 16: 24240 (NARF-61-40T)
ETHYLENE, TETRACHLORO-
determination in air, polarographic, 16: 23384 (TID-7616(p.211-21))
ETHYLENE, TETRAFLUORO- POLYMERS
diffusion of argon and helium in, radiation effects, 16: 24268
radioinduced crosslinking, localized neutron, 16: 23720(T) (AEC-tr-5144)
radioinduced graft polymerization of monomers on, for improved dyeability, 16: 24207
ETHYLENE, TRICHLORO-
determination in air, polarographic, 16: 23384 (TID-7616(p.211-21))
EUROPIUM
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
EUROPIUM ISOTOPES
percolation in soil, effects of physicochemical characteristics of soil, 16: 25050 (TID-7628(p.198-210))
EXPERIMENTAL BOILING WATER REACTOR
design modifications for operation levels up to 100 Mw(t), 16: 24964 (ANL-6552)
EXPERIMENTAL BREEDER REACTOR-II
reactivity coefficients, two-dimensional perturbation code for calculating, 16: 24441
EXPERIMENTAL GAS COOLED REACTOR
fuel assembly handling, experiment summary, 16: 24989 (TID-6702)
in-pile loop operation, hazards of hydrogen cooling, 16: 24987 (ORNL-TM-108)
in-pile loop through-tubes, bearing material selection, 16: 24170 (ORNL-TM-249)
seismic vibration effects, evaluation, 16: 24986 (ORNL-3224)
EXPERIMENTAL LOW-TEMPERATURE PROCESS HEAT REACTOR
container design analysis, effects of maximum credible accident, 16: 24997 (TID-15734)
EXPERIMENTAL ORGANIC COOLED REACTOR
control rod and drive mechanism testing, 16: 25020(R) (IDO-16761(p.98-105))
control rod drive, latch mechanism test operation in hot organic medium, 16: 24982 (IDO-16775)
development, 16: 25017(R) (IDO-16761)
in-pile loop development, 16: 25019(R) (IDO-16761(p.75-97))
safety analysis, 16: 25020(R) (IDO-16761(p.98-105))
EXPLODING WIRE PHENOMENA
shock waves from, at low ambient densities, 16: 24273 (BRL-1152)
EXPONENTIAL PILES
neutron statistical behavior in, 16: 24775
nuclear property measurements in, reliability of, 16: 24353
EXTERNAL COMBUSTION ENGINES
evaluation for transmission systems for steam-powered submarines, 16: 23799 (AD-269398)
EYES
radiation effect of deuteron microbeam on crystalline lens, 16: 23428 (BNL-6081)
radiation effects on photochemical processes, 16: 23437
radiation effects, 16: 23500
radiation effects on mammalian retina, 16: 23501
radiation effects in dogs, partial or whole-body, 16: 23419 (UR-609)

F

FALL-OUT
hazard on surface of jet aircraft, 16: 24022
monitoring atmospheric beta-emitting, Italy, Dec. 1961 and Jan. 1962, 16: 23993
monitoring in dust and rain in Germany, 1956 to 1960, 16: 24006
monitoring in Finland, 1958 and 1959, 16: 23402
monitoring in Italy, Dec. 1961, 16: 24024
monitoring in Milan, 1961, 16: 24023

monitoring in New Zealand, 16: 23408(R) (DXRL-F3)
monitoring in Project Star Dust, 16: 23407(R) (DASA-1302)
monitoring, world-wide results for March through May 1962, 16: 24012(R) (HASL-127)
prediction, use of weather radar in, 16: 23405(R) (AD-269884)
radiation hazards to milk and water supplies after nuclear attack, 16: 24014 (NP-11715)
radioactivity in rain at Westwood, N. J., 16: 23985 (NYO-9532)

FAST NEUTRONS
attenuation by high-density concretes, 16: 24227
detection and measurement by semiconductor detectors, 16: 23899 (AERE-R-3874)
diffusion parameters for, variational calculation of, 16: 24400
dosimetry outside shielding of low-power heavy water reactors, 16: 25026
effects on fertility in mice, whole-body exposure, 16: 23467
production of pure fluxes in IRT Reactor, 16: 24705
reactions with chromium, effects of energy on capture cross sections, 16: 24810

FAST REACTORS
core design for 500-Mw, sodium cooled, 16: 24479
criticality calculations, effects of neutron scattering resonances on, 16: 24387
criticality effects of core shape, 16: 24397
criticality studies and exponential measurements for, 16: 24357
criticality studies, 16: 24358
criticality studies by pulsed-source technique, 16: 24424
design and economics of 315-Mw breeder, 16: 24478
development of settled-bed, 16: 24481
development of settled bed prototype, 16: 23352(R) (BNL-705)
excursion shutdown mechanism for large oxide type, 16: 24518
expansion feedback in pulsed, 16: 24528
fuel cycle analysis, COST and CYCLE codes for, 16: 24437
fuel element irradiation testing, 16: 24641
fuel evaluation for sodium cooled, 16: 24480
fuel materials, evaluation of fused plutonium and uranium chlorides, 16: 25002(T) (AEC-tr-5161)
neutron spectrum, importance of fission neutrons in, 16: 24398
power excursions, predicting temperature transients in, 16: 24501

FATIGUE
review of low-cycle, 16: 24172 (SSC-137)

FENGHUANGITES
crystal structure and properties, 16: 23997

FERMI FAST BREEDER REACTOR
core B criticality studies, 16: 24410
core materials, neutron scattering resonances for, 16: 24387
development, January 1962, 16: 24951(R) (PRDC-TR-55)

FERMIONS
bound states of, as mesons in field theory, 16: 24722
interactions, Bardeen-Cooper-Schrieffer reduced-Hamiltonian solution for, 16: 24731
interactions, conservation testing using isotopic displacement, 16: 24742

FERMIUM ISOTOPES Fm-250
production by heavy ion reactions with heavy nuclei, cross sections for, 16: 24781 (JINR-P-896)

FETUSES
radiation effects, 16: 23472

FIELD THEORY
coördinate conditions from variational principles, 16: 24315
elementary particle interactions in, model for strong, 16: 24726
elementary particle weak interactions in, effects of conservation of axial vector current, 16: 24728
Feynman diagrams of, equations for surface of proper singularities, 16: 24683 (JINR-P-889)
gauge principle in nonleptonic weak interactions, 16: 24741
gravitation quantization in, formulation using no unphysical variables, 16: 24919
Green-function iteration method for neutral scalar fields, 16: 24847
mass of vector mesons associated with Yang-Mills, 16: 24729
meson description as bound particles, model for, 16: 24722
quantum, probability interpretation with indefinite metric, 16: 24928
quantum, using statistical quantum theory for free space, 16: 24920
scalar particle, Newton-Wigner coordinate for, 16: 24686 (JINR-P-939)
scattering equation, formulation of nonlinear singular integral Low, 16: 24913 (JINR-P-890)
scattering equation, operators connected with nonlinear singular integral Low, 16: 24914 (JINR-P-901)
symmetry properties of S-matrix with application to resonance reactions, 16: 24916 (NP-11738)
time determination from 3-dimensional geometry, 16: 24326

FILMS
preparation of thin, for beta counting, 16: 23939
removal from plates by ultrasonic vibrations, 16: 25018(R) (IDO-16761 (p.1-74))

FINLAND
fall-out monitoring, 1958 and 1959, 16: 23402

FISH
radiation effects, 16: 24044
radiation effects on quality and storage, 16: 24070
radioinduced browning, effects of sugar, 16: 24071

FISSION
nuclear drop model for, 16: 24803
processes in, chemical studies, 16: 23529(R) (TID-16024)
resonance widths in, effects of nuclear spin on, 16: 24348

FISSION PRODUCTS
characterization of gas-borne, by a diffusion cell technique, 16: 24648
determination in irradiated plutonium fuels for burnup calculations, 16: 23628 (TID-7629(p.177-83))
determination in irradiated fuel elements by gamma-excited x-ray spectra, 16: 24352
determination of gaseous, radiometric, 16: 24563
diffusion from graphite–uranium dioxide fuel spheres, 16: 24627
diffusion in graphite-uranium carbide spheres, 16: 24184(T) (AEC-tr-5213)
diffusion of gaseous, from irradiated uranium dioxide, 16: 24219
energy distributions from fuel sheet, 16: 24783 (JPL-TR-34-249)
energy from fissioning of uranium-235 by thermal and 5-Mev neutrons, 16: 24809
incorporation in enamels for use as beta sources, 16: 24698(R) (RAI-201)
reactor criticality effects, 16: 24382
reactor criticality effects, 16: 24384
reactor criticality effects, errors in predicting, 16: 24385
separation from surface of stainless steel, effects of temperature, 16: 23779 (DC-61-6-5)
separation, radiochemical, 16: 24564
yields from fast fission of uranium-238, 16: 24779 (CRRP-1090)

FISSION RECOILS
effects on xenon release from alumina, 16: 24619

FISSIONABLE MATERIAL
bibliography on recovery, 16: 23785 (ORNL-2971(Vol.3))

FLAMES
from fluorocarbons, 16: 23536

FLOWMETERS
design of radiometric, 16: 24580

FLUID FLOW
computer program for analysis in porous media, 16: 25045 (TID-7628 (p.130-44))
heat transfer in boiling liquid in annulus, 16: 23828
in multiple-channel natural convection systems, 16: 24506
of boiling liquids in tubes, 16: 23825

FLUID FLOW (LAMINAR)
magnetohydrodynamic, around plane plates, 16: 24894

FLUIDS
heat transfer by free convection in, in vertical tubes, 16: 23824

FLUORESCEIN
use in detecting radiation damage to brain, 16: 23491

FLUORIDE VOLATILITY PROCESSES
corrosion of equipment in, 16: 24118 (BMI-X-201)
development, 16: 23352(R) (BNL-705)

FLUORIDES
determination in uranium ore concentrates, method for, 16: 23608 (PG-Report-228)
separation from uranium fuel solutions by precipitation with sodium

formate, 16: 23782 (IDO-14582)
FLUORINE
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
FLUORINE ISOTOPES F-18
yields in proton spallation of copper at 24 Bev, 16: 24859
FLUORINE ISOTOPES F-19
alpha stripping reactions (α,p), cross sections, 16: 24839
FLUOROCARBON POLYMERS
radiation effects, gamma, 16: 23707 (ARL-62-350)
FLUOROCARBONS
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
radiation effects, gamma, 16: 23707 (ARL-62-350)
radiation effects of electrons, 16: 23352(R) (BNL-705)
FLUOROMETRY
development for uranium ore analysis, 16: 23770(R) (ACCO-17)
FLUOROÖRGANIC POLYMERS
radiation effects on structure of rubber-like, 16: 23756
FOOD
preservation, 16: 24045
radiation effects in preservation, survey, 16: 24039
radiation effects on wheat flour, 16: 24041
radiation effects, 16: 24044
radiation processing of packaged fish and beef, 16: 24036(T) (AEC-tr-5096)
radioinduced preservation, 16: 24040
radioinduced preservation, 16: 24061
radiopreservation of potatoes and vegetables, 16: 24059
radiosterilization, microbiological problems, 16: 24042
radiosterilization, 16: 24052
FORMAMIDE, N,N-DIMETHYL-
reactions with methylcyclohexane and toluene to form complexes, 16: 23533
FORMATES
metabolism in tumor tissues, tracer study, 16: 23367
FORMIC ACID
effects on radiolysis of ferrous sulfate dosimeter, 16: 23732
reactions with bromine and chlorine, deuterium isotope effects in photochemical, 16: 23567
FREE RADICALS
radioinduced in polymethyl methacrylate, thermal decomposition, 16: 23743
FREQUENCY CONVERTERS
use of electron beam in frequency multiplier, 16: 24297
FROGS
radiation effects on skin photoceptors, 16: 23444
radiation effects on skin photoceptors, 16: 23444
radiation effects on sciatic nerve, 16: 23486 (UCRL-9799)
FURAN
synthesis of oxygen-18-labeled, 16: 23530
FURNACES
current efficiency of aluminum electrolytic, 16: 23812
design for uranium oxide sintering, 16: 24100(R) (EURAEC-57(App.3))
design of high-temperature, for use with x-ray diffractometers, 16: 23837 (ARL-62-315)
FUSED SALTS
spectra, effects of temperature, 16: 23352(R) (BNL-705)

G

GADOLINIUM
properties as reactor control material, 16: 24422
GADOLINIUM ACETATES
preparation of anhydrous, by desolvation, 16: 23697
GADOLINIUM ISOTOPES Gd-153
gamma emission, 16: 24583
GADOLINIUM ISOTOPES Gd-157
proton reactions at 6 Mev, gamma spectra of terbium fraction from, 16: 24814
GADOLINIUM ISOTOPES Gd-158
proton reactions at 6 Mev, gamma spectra of terbium fraction from, 16: 24814
GALLATES
effects of propyl, on protein polarographic activity during radiation sickness, 16: 23516(T) (JPRS-13639)
GALLIUM
determination in presence of aluminum, titrimetric, 16: 23645
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
properties of liquid, as reactor coolant, 16: 23810 (BNL-5377)
GALLIUM ARSENIDES
radiation effects on electrical and optical properties, 16: 24234 (ARL-62-343)
GALLIUM IONS
distribution between acid solutions and bis(2-chloroethyl) ether and nitrobenzene, 16: 23582
GALLIUM ISOTOPES Ga-66
yields in proton spallation of copper at 24 Bev, 16: 24859
GALLIUM ISOTOPES Ga-67
yields in proton spallation of copper at 24 Bev, 16: 24859
GALLIUM ISOTOPES Ga-68
yields in proton spallation of copper at 24 Bev, 16: 24859
GAMMA-ABSORPTION ANALYSIS
Lorentzian packet spectral shapes in, relation to resonant-absorber thickness, 16: 24754
GAMMA RADIATION
absorption by concretes, lead, and steel, 16: 24223
absorption by concretes, 16: 24224
attenuation by high-density concretes, 16: 24227
attenuation by magnetite concretes, 16: 24230
attenuation factors for certain tissues, 16: 23459
attenuation in aluminum and iron slabs compared with Monte Carlo calculations, 16: 24906 (USNRDL-TR-558)
biological effectiveness in tissue-equivalent phantom, relative, 16: 23448
book: *Gamma Rays*, 16: 24757
detection and measurement, separation from neutron pulses, 16: 24579
detection and measurement of low-level, design of Geiger-Mueller tube for, 16: 24011 (DP-711)
detection and measurement in shelters during Upshot-Knothole tests 1 and 8, 16: 24016 (WT-789)
detection and measurement, design of spectrograph for, 16: 23844 (NDL-TR-20)
detection and measurement, apparatus for activity comparison, 16: 23866
detection and measurements of, from extended source, 16: 23959
differential dose albedo in concrete, semi-empirical formula, 16: 24599
dosimetry, advantages and basic principles of film, 16: 24028
dosimetry outside shielding of low-power heavy water reactors, 16: 25026
dosimetry using ammonium ferrous sulfate solutions, 16: 23735
effects on brain and neurons, high doses, 16: 23484
effects on brain electrical activity, 16: 23505
effects on central nervous system, 16: 23480
effects on fish and squid, browning, 16: 24071
effects on fluorocarbon molecules and polymers, 16: 23707 (ARL-62-350)
effects on foods, 16: 24040
effects on foods for preservation, 16: 24061
effects on intercapillary glomerulosclerosis development in kidneys in mice, 16: 23453
effects on photochemical processes in eye, 16: 23437
effects on stored fish, 16: 24070
effects on wheat flour, 16: 24041
field boundary and scatter at 2.2 and 16 Mev, 16: 24026
interactions with protons, computer values of mesons (α^0) photoproduction in, 16: 24680 (ISS-61/41)
interactions with mesons (π^-) cross sections for, 16: 24695 (NP-11757)
lethal effects on bacteria in milk, 16: 23455
lethal effects on bacteria, post-irradiation effects of nutritional substances, 16: 23457
lethal effects on bacteria in nutritious and non-nutritious media, effects of antibiotics, 16: 23425
lethal effects on *E. coli*, effects of physical conditions, 16: 23426
penetration of point-monodirectional through slab shields, computer program for calculation, 16: 24907 (WAPD-T-1464)

photoelectric effect, cross sections and polarization effects, 16: 24294
protection against, review, 16: 24034
reactions on nuclei at high energies, forbidden e-μ production, 16: 24724
reflection and transmission in concrete, Monte Carlo calculations, 16: 24598
scattering amplitude, 16: 24782 (JINR-P-967)
scattering by concrete, 16: 24911
scattering by nearby surfaces, 16: 24604
scattering by water at 0.66 Mev, energy distributions from, 16: 24693 (NP-11538)
transmission in vertical slab, geometry, and barrier attenuation, 16: 24603
transmission of point monodirectional, through slab shields, 16: 24601
transmission through aluminum and iron slabs, angular distribution of dose rate, 16: 24600
transport theory, application of the spherical harmonics technique, 16: 24602

GAMMA SOURCES
dosimetry studies, 16: 23399
program for analysis of infinite, 16: 24287 (UCRL-6891)
use in radiography of shipbuilding materials, 16: 24067

GAMMA SPECTRA
ambient in the lower atmosphere, theory, 16: 24794(R) (TID-15211)

GAMMA SPECTROMETERS
description of measuring equipment, 16: 23946
design and performance for detecting solar gamma radiation, 16: 23926
design for measurement of gamma spectra from pulsed reactors or weapons, 16: 23844 (NDL-TR-20)
design for studying lunar composition, 16: 23930
design of balloon-borne, for telemetering spectra from high altitudes, 16: 23923 (UAC-6125)
development for analytical control inside hot cells, 16: 23618 (TID-7629(p.42-53))
use for nondestructive inspection, 16: 24555

GAMMA SPECTROSCOPY
low-activity by grey-wedge method, 16: 23953
pulse-height spectra analysis in scintillation, 16: 23914

GAS COOLED REACTORS
containment vessel design and cost for high-temperature, 16: 24489
control system design for high-temperature, 16: 24968 (APEX-800(Pt.F))
coolant decontamination, removal of radioiodine at high temperatures, 16: 24649
design and power plant component specifications for high-temperature, 16: 24967 (APEX-800(Pt.A))
design of foreign, survey, 16: 24975 (DC-60-10-154)
design parameters for power, 16: 25007
in-pile loop design and operation, 16: 24497

GAS FLOW (TURBULENT)
diffusion in ground layer of atmosphere, 16: 23991(T) (AWRE-Trans-34)

GASES
detection using radioactive clathrates, 16: 24576
diffusion of electrons and ions in neutral, theory, 16: 24272 (APED-3959)
diffusion of radioactive in solids, solution of equations for, 16: 23763
electric conductivity of high temperature, method for measuring, 16: 24282 (NP-11906)
electron diffusion in scattering, 16: 24676 (APED-3960)
heat and mass transfer interfacial rates for large gradients of concentration and temperature, 16: 23822 (NP-11818)
ionization, discharge apparatus for, 16: 23815(P)
neutron attenuation by heavy, 16: 24378

GEIGER-MUELLER TUBES
calibration for direct counting of radon in atmosphere, 16: 23833 (AEET/AM/24)
design for low level beta-gamma monitoring, 16: 24011 (DP-711)

GELATIN
roll in emulsions, latent image study of, 16: 23967 (ANL-6515(p.81-60))

GENETICS
radiation effects on human, 16: 23461
radioinduced plant mutations, 16: 23469
radioinduced plant mutations, 16: 23369

GEOLOGY
age determination in, radiometric, 16: 24007
effects on dispersion of fluid flow, 16: 25047 (TID-7628(p.166-78))
survey of Hanford Plant area, 16: 23963 (CEX-59.4.11)

GEOMAGNETIC FIELDS
effects on cosmic radiation intensities, 16: 24664
reactions with solar corpuscle stream, 16: 24657 (R62SD30)
source of external, diamagnetism of Van Allen radiation belt as, 16: 24663
variations during geomagnetic storms, 16: 24307

GEOMAGNETIC STORMS
effects on cosmic radiation intensity, 16: 24307
excitation at polar caps, by solar energetic particles, 16: 24305
measurements during Nov. 1960, 16: 24306
production by solar events, 16: 24667

GERMANIUM
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
Fermi-levels in, 16: 24158 (K-1526)
radiation effects on electrical and optical properties, 16: 24234 (ARL-62-343)
solubility in bismuth at 300 to 700°C, 16: 24216

GERMANIUM CRYSTALS
electron anisotropies and drift velocities in n-type, at high energies, 16: 24323
radiation effects of slow neutrons, 16: 24245(T) (AEC-tr-5147)

GERMANIUM ISOTOPES Ge-70
neutron reactions (n,γ), effects on germanium monocrystals, 16: 24245(T) (AEC-tr-5147)

GERMANIUM ISOTOPES Ge-74
neutron reactions (n,γ), effects on germanium monocrystals, 16: 24245(T) (AEC-tr-5147)
neutron reactions (n,γ), activation measurements for, 16: 24787 (NP-11793)

GERMANIUM JUNCTIONS
radiation effects on p-n-p junction transistors, gamma, 16: 24252

GERMANY
fall-out monitoring in dust and rain, 1956 to 1960, 16: 24006

GLASS
analysis for potassium, radiological, 16: 23656

GLOW DISCHARGES
afterglow, ion-neutral collisions in, 16: 24276 (GA-2824)

GLUTAMIC ACID
complexing with uranyl ion, bonding and stability constants, 16: 23387 (UR-611)

GLYCEROL
spin-lattice relaxation of titanium chlorides in, at 77°K, 16: 23703

GLYCOLIC ACID
solvent properties for rare earths from ion exchange materials, 16: 23571

GLYCOSIDES
synthesis of two carbon-14-labeled pyranosides, 16: 23556

GOLD
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
determination in biological materials, activation, 16: 23403
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
separation from aqueous solutions by mixer-settlers, review, 16: 23793

GOLD FOILS
neutron flux depression by, Monte Carlo calculation of, 16: 24362
neutron flux measurements with, corrections for, 16: 24361
neutron flux measurements with, at 5 ev, 16: 23841 (CEA-2162)
neutron flux perturbation by, 16: 24359

GOLD ISOTOPES Au-196
decay and half life, 16: 24789(R) (NP-11874)

GOLD ISOTOPES Au-197
carbon-12 reactions at 60 to 120 Mev, products from, 16: 24854 (UCRL-9950)
charged particle fission, energetics of, 16: 24350
neutron photoproduction cross sections, 16: 24778 (CEA-2148)
neutron reactions (n,2n) at 14.1 Mev, cross sections, 16: 24789(R) (NP-11874)

GOLD ISOTOPES Au-198
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
diagnostic uses of colloidal, for hepatic vesicular affections,

16: 23371 (CEA-E994)
GOLD ISOTOPES Au-199
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
GONADS
radiation effects on oöcyte maturation in mice, 16: 23520
radiation effects on morphology of fertilized ova in hamster, 16: 23416 (TID-16121)
radiosensitivity of uterus, effects of stage of estrogenic cycle, 16: 23436
GRAPHITE
atomic collisions in, focusing conditions for elastic, 16: 24206
coating with zirconium isopropoxide, 16: 24147 (ASD-TDR-62-90)
combustion, 16: 24482
diffusion and sorption of xenon in high density, at 750 and 1000°C, 16: 23700
neutron diffusion lengths in, 16: 24375
properties, structure, and use of pyrolytic, review, 16: 24189
radiography, radiopaque penetrant for, 16: 23978
reactions with carbon dioxide and oxygen, 16: 23678
thermal conductivity of artificial, relation of electric conductance to, 16: 24143 (AERE-R-3973)
thermal conductivity at 1300 to 2400°C in vacuum, 16: 24209
GRAPHITE MODERATED REACTORS
neutron flux distribution in cavity containing, 16: 24428
GRAPHITE–SILICON CARBIDE SYSTEMS
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
GRAPHITE–THORIUM CARBIDE–URANIUM CARBIDE SYSTEMS
diffusion of krypton and xenon from, 16: 24628
GRAPHITE–THORIUM OXIDE SYSTEMS
neutron resonance absorption in, 16: 24394
GRAPHITE–URANIUM CARBIDE SYSTEMS
fission product diffusion in, 16: 24184(T) (AEC-tr-5213)
GRAPHITE–URANIUM(IV) OXIDE SYSTEMS
diffusion of fission products from, 16: 24627
melting and casting reacted and unreacted, skull, 16: 24134 (TID-15337)
GRAPHITE–URANIUM SYSTEMS
criticality studies, 16: 24356
GRAPHITE–ZIRCONIUM CARBIDE SYSTEMS
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
GRASSHOPPERS
radioinduced lethality in embryos, relative biological effectiveness of 14 Mev neutrons and 200 kvp x rays for, 16: 23413 (TID-15962)
GRAVITATION
quantization, formulation using no potentials, 16: 24918
quantization, formulation using no unphysical variables, 16: 24919
GREAT BRITAIN
waste disposal practices, 16: 25075 (TID-7628(p.583-9))
GRIGNARD REAGENTS
reactions with carbon-14 dioxide, equipment, 16: 23531
GROUND
radioactivity, from stack disposal of reactor wastes, 16: 25079
GROUND WATERS
dispersion, effects of geologic features, 16: 25047 (TID-7628(p.166-78))
flow in porous media, mathematical analysis, 16: 25045 (TID-7628(p.130-44))
flow measurements, tracer method, 16: 25046 (TID-7628(p.155-65))
measurement of movements in soil, 16: 25042 (TID-7628(p.77-98))

H

HAFNIUM
determination, 16: 23653
determination in niobium and zirconium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
separation from zirconium in sulfuric solution by anion exchange, 16: 23792(T) (AEC-tr-5099)
HAFNIUM ALCOHOLATES
isopropoxide, preparation by ammonium method, 16: 24147 (ASD-TDR-62-90)
HAFNIUM CHLORIDES
reactions with potassium chloride, tracer study of gaseous, 16: 23709 (JINR-P-957)
HAFNIUM COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
HAFNIUM IODIDES
structure of trivalent, 16: 23682
HAFNIUM ISOTOPES Hf-175
decay scheme, 16: 24806
HAFNIUM ISOTOPES Hf-181
beta decay scheme, 16: 24807
HAFNIUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
HAFNIUM SILICIDES
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
HAFNIUM–TANTALUM–TUNGSTEN ALLOYS
coating with aluminum-tin alloys, 16: 24163(R) (NP-11711)
coating with ceramics and metals, 16: 24148(R) (ASD-TR-61-676)
HAIR
analysis for phosphorus and sulfur in human, radiochemical, 16: 23379 (TID-7616(p.89-97))
HALLAM POWER REACTOR
fuel element criticality studies, uranium carbide, 16: 24419
fuel element lattices, thermal utilization, 16: 24904 (NAA-SR-Memo-7134)
HAMBURG ELECTRON SYNCHROTRON
magnet configuration calculation, 16: 24870(T) (UCRL-Trans-816)
HAMSTERS
radiation effects on central nervous system, 16: 23482
radiation effects on central nervous system, electron microscope study, 16: 23485
radiation effects on morphology of fertilized ova and embryo development, ova exposure, 16: 23416 (TID-16121)
HANFORD AREA (WASH.)
aeroradioactivity and geology survey, 16: 23983 (CEX-59.4.11)
radiological conditions in vicinity, Jan. to March 1962, evaluation, 16: 23409(R) (HW-73366)
HANFORD PRODUCTION REACTORS (N)
fuel element reclamation, processing facility shielding requirements, 16: 23780 (HW-68021)
HANFORD WORKS, RICHLAND, WASH.
ground disposal of radioactive wastes, 16: 25069 (TID-7628(p.491-505))
HARBORS
sand and silt drift measurement at Portugal, tracer study, 16: 24005
sand drift measurement at Japanese, tracer study, 16: 24003
sedimentation drift measurement at Europoort, using radioisotopes, 16: 24004
sedimentation measurement in Bombay, tracer study, 16: 24002
HEALTH PHYSICS
in iron and steel industry, 16: 24031
radiation hygiene in agriculture, 16: 24030
HEART
localization of cardiac shunts, tracer method, 16: 23368
HEAT
physiological factors in biological systems, 16: 23376 (TID-7616 (p.61-8))
HEAT EXCHANGERS
heat transfer and pressure drop in flow across tube bank, 16: 23826
heat transfer in baffled, 16: 23827
HEAT-RESISTING ALLOYS
properties for nuclear superheat use, survey, 16: 24155 (GEAP-3875)
HEAT TRANSFER
across annular gap, analysis of variable gas bond for, 16: 23821 (NAA-SR-Memo-7182)
application of steam energy flow to reactor design, 16: 24508
boiling and burnout correlations, 16: 23817 (HW-71684)
boiling and burnout in small channels, forced-convection, 16: 23823 (NP-11831)
burnout in wet steam flowing in round tubes, 16: 23816 (EURAEC-42)
flow and stability problems in multiple-channel natural convection systems, 16: 24506

from multi-layer elements, calculation of, 16: 23829
in annular fuel elements, fuel-cladding gap effects, 16: 24502
in baffled heat exchangers, 16: 23827
in boiling water reactors, 16: 24931(R) (ANL-6561)
in flow across tube bank in heat exchanger, 16: 23826
in flow of boiling liquid in annulus, 16: 23828
in gases, interfacial rates for large gradients of concentration and temperature, 16: 23822 (NP-11818)
in one-dimensional geometry with nonuniform internal heat generation, 16: 24500
in organic moderated reactors, effects of core length, 16: 24946 (NAA-SR-Memo-4325(Rev.1))
in reactor fuel elements, local film coefficients due to boundary layer turbulence promoters, 16: 24504
in stainless steel tubes, effects of corroded surfaces, 16: 24127
significant parameters in departure from nucleate boiling, 16: 24507

HEAT TRANSFER SYSTEMS
design for organic coolant fouling studies under electron irradiation, 16: 24460
development of liquid metal, for university, 16: 24651

HEAVY WATER REACTORS
components, fabrication methods and materials for, 16: 24149(R) (BMI-X-204)
coolant leakage tests, 16: 24499
critical experiments on JRR-2, 16: 25022 (JAERI-1025)
design of ORGEL, 16: 24450
design on ESSOR test facility for ORGEL, 16: 24451
fuel assembly design, FAD program for, 16: 24435
photoneutron production in, by delayed gammas following uranium-235 irradiation, 16: 24495
power excursion tests at ambient temperature, effects of system pressure, 16: 24521
power limiting and shutdown mechanisms in, 16: 24516
shielding calculations for British Daphne, 16: 25026

HELIUM
diffusion in polymers, radiation effects, 16: 24268
electric conductivity decay measurements in plasma, 16: 24881 (AFCRL-1119)
electron diffusion and mobility in, 16: 24281 (NP-11846)
interactions with mesons (π^-) at 153 Mev, angular distributions and cross sections, 16: 24682 (JINR-P-868)
ion-neutral reactions in afterglows, 16: 24276 (GA-2824)
ionization of gases by metastable atoms, cross sections, 16: 24296
leakage control of, used as atmosphere in reactors, 16: 24498
properties as reactor coolant, 16: 23930 (BNL-5377)

HELIUM IONS
hydrogen reactions, cross sections for charge transfer, 16: 24780 (GA-2783)
spectra, analysis of Doppler broadening of complex 4686 A line, 16: 24283 (NYO-7885)

HELIUM ISOTOPES He-3
fission reactions with heavy nuclei, energetics of, 16: 24350
magnetic properties at low temperatures, 16: 24284 (TID-15973)
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858

HELIUM ISOTOPES He-3 (SOLID)
ground state wave function for, 16: 24322
thermal capacity at 0.3 to 2°K under pressure, 16: 23689

HELIUM ISOTOPES He-4
deuteron reactions (d,αp) at 8 to 11 Mev, neutron spectra, 16: 24821

HEMATO-ENCEPHALIC BARRIER
radiation effects, spinal cord exposure, 16: 23482
radiation effects, 16: 23493

HEMATOPOIETIC SYSTEM
radiosensitivity, 16: 23445

HEPARIN
effects on blood picture, 16: 23434 (BNL-6011)

HEPTANE, 3-METHYL-
cyclization of carbon-14-labeled, catalytic, 16: 23565

HETEROGENEOUS REACTORS
neutron Doppler broadened resonance absorption in, 16: 24439
neutron spectra calculations for, comparison of, 16: 24368

HETEROPOLY ACIDS
preparation and properties of niobium and titanium molybdates, 16: 23680

HIGH-ALTITUDE EXPLOSIONS
effects on communication systems, 16: 23994

HIGH ENERGY INJECTION DEVICES
development status of DCX-2, 16: 24445

HOLMIUM
vapor pressure at 650 to 1750°C, 16: 24188

HOLMIUM CARBIDES
decomposition, 16: 24188

HOMOGENEOUS REACTORS
fuel solutions for, composition, 16: 24953(T) (AEC-tr-5165)
hyrodynamics of uranium dioxide suspension in, 16: 25003(T) (AEC-tr-5198)
power bursts in, production of void and pressure by fission track nucleation of radiolytic gas bubbles, 16: 24533

HYDRACRYLIC ACID, β-LACTONE
radioinduced solid-state polymerization, 16: 23744

HYDRAULICS
development in boiling water reactor technology, 16: 24931(R) (ANL-6561)
in organic moderated reactors, effects of core length, 16: 24946 (NAA-SR-Memo-4325(Rev.1))

HYDRAZINE
determination in 35% solutions, 16: 23611 (PG-Report-342)

HYDRAZINE, p-NITROPHENYL
reactions with aldehydes, carbon-14 and tritium isotope effects, 16: 23577

HYDRAZINE, PHENYL-
reactions with aldehydes, carbon-14 and tritium isotope effects, 16: 23577

HYDROBROMIC ACID
hydrogen isotope exchange with naphthalene, 16: 23569

HYDROCARBONS
radioinduced oxidation, in petroleum industry, 16: 23751
reactions with recoil sulfur-35 atoms, 16: 23550

HYDROCHLORIC ACID
electrolytic effects on sedimentation rate of uranium (IV–VI) oxide suspensions, 16: 23699
properties as eluant for inorganic ion chromatography on zirconium phosphate paper, 16: 23650
radiolysis of liquid and solid, hydrogen yields, 16: 23731

HYDROCINNAMALDEHYDE
reactions with carbonyl reagents, carbon-14 and tritium isotope effects, 16: 23577

HYDROFLUORIC ACID–NITRIC ACID SYSTEMS
corrosive effects on stainless steel type 304-L, effects of aluminum nitrate on, 16: 24120 (HW-73211)

HYDROGEN
determination in uranium for control in fuel processing steps, 16: 23639 (TID-7629(p.316-27))
electron diffusion and mobility in, 16: 24281 (NP-11846)
electron diffusion in, at low energies, 16: 24325
hazards of use for cooling high temperature in-pile loops, 16: 24987 (ORNL-TM-108)
interactions with mesons (π^-) at 16 Bev/c, meson (π) production, 16: 24719
ionization by metastable helium atoms, cross sections, 16: 24296
mesons (π^-) reactions at 75 Mev, charge-exchange in, 16: 24689 (JINR-P-948)
neutron diffusion in, 16: 24758 (AE-71)
neutron reactions, proton recoil energy loss distributions from, 16: 24791 (ORNL-3089)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
neutron transmission through slab of liquid, calculation by Monte Carlo method, 16: 24605
properties as reactor coolant, 16: 23930 (BNL-5377)
proton reactions, cross sections for charge transfer, 16: 24780 (GA-2783)
reactions, survey from 1956 to 1961 on electrolytic, 16: 23671 (NRL-5775)

reactions with helium and oxygen ions, cross sections for charge transfer, 16: 24780 (GA-2783)
reactions with uranium oxides and uranyl fluorides, thermodynamic characteristics of reduction in, 16: 24187
sorption by Molecular Sieve 4A at –196°C, 16: 23579
sorption by Zircaloy-2 and -4, 16: 24128 (WAPD-T-1281)
yield in radiolysis of sodium hydroxide–sodium sulfite in aqueous solution, 16: 23716 (PAN-290/ChR)
HYDROGEN (LIQUID)
absorption of negative mesons, 16: 24822
hazards of use in bubble chambers, study, 16: 24015 (TID-15985)
HYDROGEN IONS
detection and measurement by silicon surface barrier detector, 16: 23904 (SCDC-2522)
HYDROGEN ISOTOPES
exchange between ammonia and benzene, 16: 23569
exchange between hydrobromic acid and napthalene, 16: 23569
separation by electrolysis, effects of temperature, 16: 24078
HYDROGEN–LANTHANUM SYSTEMS
properties, 16: 23683
HYDROGEN MODERATED REACTORS
criticality studies of beryllium oxide-containing, 16: 24411
criticality studies of beryllium oxide-containing, 16: 24412
neutron spectra in, temperature coefficient of, 16: 24380
neutron spectra in, temperature coefficient of, 16: 24381
HYDROGEN–NITROGEN SYSTEMS
ion-neutral reactions in afterglows, 16: 24276 (GA-2824)
HYDROGEN PEROXIDES
decomposition, combined effects of catalyst and ultraviolet radiation on, 16: 23724(T) (AEC-tr-5153)
HYDROLOGY
waste-disposal, equipment and methods for study, 16: 25043 (TID-7628 (p.99-114))
HYDROMAGNETIC WAVES
propagation by incompressible viscous conducting flow around plates, 16: 24894
HYPERONS
magnetic moments from strange-particle interactions at high energies, 16: 24739
HYPERONS (Λ)
interactions with protons at 1.15 Bev/c, elastic scattering cross section, 16: 24710
parity relative to hyperons (Σ), effects on meson (K^-)-proton scattering, 16: 24704
HYPERONS (Λ°)
decay in spark chambers, ionization effects, 16: 23908
production in meson (π^-) interactions with protons at 16 Bev/c, 16: 24737
HYPERONS (Σ)
decays, model of pionic, 16: 24675 (AFOSR-2637)
parity relative to hyperons (Λ), effects on meson (K^-)-proton scattering, 16: 24704
production in meson (π^-) interactions with protons at 16 Bev/c, 16: 24737

I

ICE
neutron diffusion and thermalization at –196°C, 16: 24765(T) (AEC-tr-5143)
IMAGE BRIGHTNESS INTENSIFIERS
description and performance of transmission secondary emission, 16: 23892
description of four-stage, 16: 23885
design and performance of transmission-type, 16: 23891
efficiency for photoelectron detection, 16: 23906
IMMUNITY
reaction mechanisms in secondary disease of lethally irradiated mice protected by homologous bone marrow, 16: 23521
IMPACT SHOCK
measurement, equipment design for, 16: 24176 (WADD-TR-60-749 (Pt.II))
IN-PILE LOOPS
design, 16: 24455
design and operation in high-temperature gas-cooled power reactor, 16: 24497
design and operation of Brookhaven chemonuclear, 16: 24586
development for studies of radiation effects on organic coolants, 16: 24941(R) (IDO-11101)
hazards of operating hydrogen cooled in EGCR, 16: 24987 (ORNL-TM-108)
INCOMPRESSIBLE FLOW
magnetohydrodynamic viscous, around plane plates, 16: 24894
INDIUM
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
electron energy-loss spectra in, 16: 24329
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
INDIUM FOILS
neutron flux perturbation by, 16: 24359
INDIUM IONS
distribution between acid solutions and bis(2-chloroethyl) ether and nitrobenzene, 16: 23582
INDIUM PHOSPHIDES
radiation effects on electrical and optical properties, 16: 24234 (ARL-62-343)
INFRARED RADIATION
radiant emission measurement techniques using, 16: 23973 (ANL-6515 (p.163-86))
INFRARED SPECTROMETERS
development for continuous, analysis of heavy water for isotopic purity, 16: 23623 (TID-7629(p.91-109))
INITIAL ENGINE TEST
by-pass valve bearing development, 16: 23801 (DC-60-1-37)
disassembly of D102A power plant, 16: 24977 (DC-61-6-16)
startup instrumentation for HTRE-1, 16: 24974 (DC-55-7-61)
INSECTICIDES
synthesis of carbon-14-labeled Aldrin and Dieldrin, 16: 23554
INSECTS
radiation effects, as means of control in food industry, 16: 24053
INSTRUMENTATION
identification symbols for, system summary, 16: 23353 (CF-57-2-1 (Rev.1))
reliability monitoring with magnetic amplifiers, 16: 23861(T) (CEA-tr-A-1126)
survey of nanosecond techniques, 16: 23912
INSTRUMENTS
blast effects in German underground personnel shelters, 16: 24020 (WT-1454)
design and operation of measuring and scanning projector for bubble chamber film, 16: 23851 (UCRL-10109)
development and evaluation of nucleometer for surface area measurements on uranium compounds, 16: 23640 (TID-7629(p.331-44))
development for continuous monitoring of beryllium in atmosphere, 16: 23615 (TID-7629(p.16-21))
development for measuring blast effects on communal shelters, 16: 23856 (WT-790)
maintenance in submarine propulsion systems, 16: 24963 (AD-269402)
operation and service in spectroscopy of transistorized, manual for, 16: 23846 (ORNL-TM-137)
operation instructions for coil indicators, 16: 23862(T) (SCL-T-419)
INTERNATIONAL ATOMIC ENERGY AGENCY
research programs on radioactive waste management, 16: 25076 (TID-7628(p.590-601))
INTESTINE
absorption of calcium and strontium, tracer study, 16: 23398 (HW-SA-2519)
radiation effects on cell histology, whole-body exposure, 16: 23519
IODIDE IONS
iodine exchange with 2,4-dinitroiodobenzene, 16: 23562
IODINE
absorption at high temperatures by graphite, 16: 23352(R) (BNL-705)
diffusion in polycarbonate resin, 16: 24195
exchange between 2,4-dinitroiodobenzene and iodide ions, 16: 23562

exchange with methyl iodide in gaseous phase, 16: 23588
exchange with 4-iodo-antipyrine, solvent effects, 16: 23573
removal of radioactive, from gases at high temperatures, 16: 24649
separation of fission product, radiochemical, 16: 24564
uptake by rat thyroid, effects of x radiation on, 16: 23431
IODINE ISOTOPES
diffusion from irradiated uranium dioxide, 16: 24219
IODINE ISOTOPES I-127
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
IODINE ISOTOPES I-131
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
diagnostic uses with Rose Bengal for hepatic vesicular affections, 16: 23371 (CEA-1994)
diffusion in thorium dioxide, 16: 23674(T) (AEC-tr-5178)
effects on survival of rats and mice receiving subsequent lethal doses of x radiation, 16: 23443
preparation and use, 16: 24075
sorption on platinum electrode surfaces, in electrolytic deposition, 16: 24085
tracer use for determination of scandium, 16: 23736
IODINE ISOTOPES I-132
bibliography, 1939 to 1961, 16: 23665 (BLG/B-2)
IODINE ISOTOPES I-133
bibliography, 1939 to 1961, 16: 23666 (BLG/B-3)
IODOORGANIC COMPOUNDS
synthesis of iodine-labeled, 16: 23559
ION BEAMS
charge compensation by electrons in one-dimensional, 16: 24288(T) (FTD-TT-62-317)
use in localization of lesions in neurology, 16: 23488
ION EXCHANGE
development for use in uranium ore processing, 16: 23770(R) (ACCO-17)
ION EXCHANGE MATERIALS
dissociation constants of acid and alkaline forms of imino-diacetate groups in Dowex A-1, 16: 23590
performance of Hungarian, for uranium processing, 16: 23795
reactions with strontium, tracer study, 16: 25049 (TID-7628(p.187-97))
scavenging properties for radionuclides, 16: 25053 (TID-7628(p.237-47))
sorptive properties of Molecular Sieve 4A for hydrogen at −196°C, 16: 23579
sorptive properties for elements from solution, 16: 23580
ION EXCHANGE PROCESSES
design for separating americium and curium, 16: 24343
ION SOURCES
efficiencies of h-f Thomsmans, 16: 23933
IONIZATION CHAMBERS
device for comparing gamma activities using, 16: 23866
IONOSPHERE
disturbances of solar origin, measurements during Nov. 1960, 16: 24306
IONS
cross sections for inelastic collisions with electrons, calculation methods, 16: 24285(R) (TID-16127)
diffusion in neutral gas, theory, 16: 24272 (APED-3959)
reactions of positive, with gaseous molecules at 3×10^{-3} to 10^{3} ev, 16: 23725(T) (AEC-tr-5155)
sorption on zirconium phosphate paper, chromatographic, 16: 23650
IRIDIUM COMPLEXES
decomposition of bromo-, effects of bromine-80m isomeric transitions in, 16: 23764
IRIDIUM ISOTOPES Ir-192
tracer use in measurement of sedimentation drift, 16: 24001
IRON
analysis for chromium, activation, 16: 23649
analysis for uranium, methods for, 16: 23604 (NP-11873)
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
corrosion inhibition, 16: 23593
determination in biological materials, activation, 16: 23403
determination in niobium and zirconium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
gamma attenuation in slabs, compared with Monte Carlo calculations, 16: 24906 (USNRDL-TR-558)
gamma-ray transmission through slabs, angular distribution of dose rate, 16: 24600
mesic atoms of, meson (μ^-) decay in, 16: 24278 (JINR-P-971)
meson (μ) decay in, 16: 24819
metabolism in blood, effects of whole-body irradiation, 16: 23430
metabolism in blood diseases, tracer study, 16: 23391
movement in peppermint plant, 16: 23389
neutron inelastic removal cross sections, 16: 24408
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
neutron scattering resonance cross sections for, fast, 16: 24387
radioinduced heating in Ground Test Reactor, comparison with computer code results, 16: 24240 (NARF-61-40T)
surface friction in sliding on iron, effects of surface films, 16: 23803 (R60GL185)
IRON ALLOYS
analysis for uranium, methods for, 16: 23604 (NP-11873)
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
IRON BORIDES
electronic structure, 16: 23662 (AE-76)
IRON(II) COMPOUNDS
iron-57 electric quadrupole splitting and nuclear volume effect in ionic, 16: 23713 (NP-11788)
IRON CRYSTALS
magnetic induction in single, 16: 24211
IRON GLUCONATES
excretion by mice, 16: 23871
IRON(II) IONS
radioinduced chain oxidation in air saturated acid solution containing ethanol, mechanism, 16: 23715 (PAN-285/ChR)
IRON(III) IONS
separation from cobalt(II) ions by anion exchange, 16: 24081
yields in radiolysis of iron(II) in presence of ethanol, 16: 23715 (PAN-285/ChR)
IRON ISOTOPES Fe-52
yields in proton spallation of copper at 24 Bev, 16: 24859
IRON ISOTOPES Fe-54
neutron reactions, cross section resonances, 16: 24818
IRON ISOTOPES Fe-55
yields in proton spallation of copper at 24 Bev, 16: 24859
IRON ISOTOPES Fe-56
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
neutron reactions, cross section resonances, 16: 24818
IRON ISOTOPES Fe-57
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
electric quadrupole splitting and nuclear volume effect in ionic compounds, Mossbauer spectra, 16: 23713 (NP-11788)
IRON ISOTOPES Fe-59
production of high-activity, 16: 24081
yields in proton spallation of copper at 24 Bev, 16: 24859
IRON–MOLYBDENUM–NICKEL ALLOYS
corrosion by chloride solutions, 16: 23528(R) (ORNL-3290)
IRON OXIDES
reactor reflector critical thickness, 16: 24410
thermal stabilization effects on zirconium oxides, 16: 24203
IRON(II) SULFATES
excretion by mice, 16: 23871
radiolysis of dosimeter, effects of formic acid, 16: 23732
IRON(III) SULFATES
excretion by mice, 16: 23871
IRON–WATER SYSTEMS
neutron flux distributions, 16: 24597
IRRADIATION FACILITIES
design for organic coolant fouling studies under electron irradiation, 16: 24460
shielding, effects of gamma scattering by concrete, 16: 24911
utilization factor of gamma, method of increasing, 16: 24246
IRRADIATIONS
calculation method for specific activities produced by intermittent,

16: 23712 (NP-11744)
ISOCYANATES
dimerization, carbon-14 tracer study, 16: 23557
preparation of carbon-14-labeled, 16: 23557
ISOTHIOCYANATES
preparation of carbon-14-labeled, 16: 23557
ISOTOPE EFFECTS
in beta decay of natural lead isotopes, 16: 23722(T) (AEC-tr-5150)
ISOTOPE SEPARATION METHODS
absorption theory, 16: 24080
use of solid solutions, 16: 24084
ITALY
fall-out monitoring, Dec. 1961, 16: 24024
fall-out monitoring in Milan, 1961, 16: 24023
fall-out monitoring, atmospheric beta-emitting, 16: 23993

J

JOURNAL BEARINGS
load capacity of external pressurized gas lubricated, 16: 23806 (TID-15295)
motion, time dependent fluid film forces on, 16: 23805 (TID-15212)

K

KEROSENE
analysis for tributyl phosphate by infrared spectrometry, 16: 23612 (PG-Report-344)
radioinduced oxidation on industrial scale, 16: 23751
KETENE
radioinduced solid-state polymerization of di-, 16: 23744
KIDNEYS
disease diagnosis using mercury-203-labeled chlormerodrin, 16: 23400
radiation effects on development of intercapillary glomerulosclerosis in, in mice, 16: 23453
KRYPTON
alkali-atom electron-spin-resonance spectra in, at 4.2°K, 16: 23702
diffusion from graphite–thorium carbide–uranium carbide systems, 16: 24628
ionization by metastable helium atoms, cross sections, 16: 24296
KRYPTON ISOTOPES
diffusion from irradiated uranium dioxide, 16: 24219
KRYPTON ISOTOPES Kr-82
energy levels from strontium-82 decay, 16: 24812
KRYPTON ISOTOPES Kr-85
diffusion in uranium oxides, 16: 24183(T) (AEC-tr-5206)
diffusion in uranium carbide, 16: 24184(T) (AEC-tr-5213)
KRYPTON ISOTOPES Kr-87
diffusion in uranium carbide, 16: 24184(T) (AEC-tr-5213)

L

LABORATORIES
description of Weimar radioisotope, for building materials research, 16: 23981
for radioisotopes, in Czechoslovakia, 16: 23809
history and research at Veszprem, Hungary radiochemical, 16: 23726(T) (JPRS-14324)
waste disposal, dilution and storage calculations, 16: 25077
LABORATORY EQUIPMENT
design for synthesis of carbon-14-labeled acids from Grignard reagents, 16: 23531
LABORATORY FURNITURE
design of hood for radioisotopes, 16: 23811
LACTIC ACID
solvent properties for rare earths from ion exchange materials, 16: 23571
LACTIC ACID, 2-METHYL-
solvent properties for rare earths from ion exchange materials, 16: 23571
LANTHANUM
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
exchange between dioxide and trifluoride in molten fluoride mixtures, 16: 23595
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
LANTHANUM ACETATES
preparation of anhydrous, by desolvation, 16: 23697
LANTHANUM FLUORIDES
solubility in molten fluoride mixtures, 16: 23595
LANTHANUM ISOTOPES La-139
neutron photoproduction cross sections, 16: 24778 (CEA-2148)
LEACHING
methods for uranium in Hungary, acid and carbonate, 16: 23795
LEAD
determination in biological materials, activation, 16: 23403
determination in ointments and pastes by beta backscattering, 16: 24065
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
diffusion of liquid, neutron scattering studies of, 16: 24271 (AERE-R-4043)
gamma and x-ray absorption by, 16: 24223
meson (μ^-) and (μ^+) Mott scattering cross sections for, 16: 24747
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
photoelectric effect, cross sections and polarization effects, 16: 24294
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
radioinduced heating in Ground Test Reactor, comparison with computer code results, 16: 24240 (NARF-61-40T)
LEAD HAFNATES
phase transitions, effects of barium and strontium hafnates, 16: 23688
LEAD(II) IONS
electrochemical activity coefficients, 16: 23534
reactions with Dowex 50 resin cation exchanger, equilibrium constants, 16: 23534
LEAD ISOTOPES Pb-206
charged particle fission, energetics of, 16: 24350
LEAD ISOTOPES Pb-207
alpha reactions (α,n) at 19.7 to 24.0 Mev, angular distributions and ranges from, 16: 24853 (UCRL-9595-Rev.11)
LEAD ISOTOPES Pb-208
alpha reactions (α,2n) at 21.7 to 37.2 Mev, angular distributions and ranges from, 16: 24853 (UCRL-9595-Rev.11)
neutron photoproduction cross sections, 16: 24778 (CEA-2148)
LEAD ISOTOPES Pb-210
beta decay, isotopes effect in, 16: 23722(T) (AEC-tr-5150)
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
LEAD ISOTOPES Pb-212
beta decay, isotopes effect in, 16: 23722(T) (AEC-tr-5150)
LEAD TELLURIDES
properties, mechanical and thermal, 16: 24161 (NAA-SR-Memo-7172)
LEAD, TETRAPHENYL-
vapor pressure and heat of sublimation, 16: 23589
LEAK DETECTORS
design and performance of radiometric, for automotive sealed beam headlamps, 16: 24585
design for conservation of helium atmosphere in reactors, 16: 24498
LECTURES
on nuclear reactions, 16: 24799(T) (AEC-tr-5160)
on quantum electrodynamics, 16: 24915 (NP-11612(Vol.II))
LEPTONS
doublet scheme for, 16: 24694 (NP-11731)
interactions, conservation testing using isotopic displacement, 16: 24742
LEUKOCYTES
chromosome breakage in, as biological dosimeter, 16: 23465
radiation effects on lipid metabolism, 16: 23415(R) (TID-16080)
LEVEL INDICATORS
description and use of gamma-ray, 16: 23810
use of radioisotopes in, 16: 24069
LEVEL REGULATORS
use of cobalt-60, in pulp bleaching tower, 16: 24063
LIGHT
scattering by small particles behind shock waves, 16: 24889 (NP-11601)

LIGHT SOURCES
review of self-luminous paints, 16: 24055
review of self-luminous paints, 16: 24056
LIMESTONE
determination in schist, radiometric, 16: 23996
LIMONITE CONCRETES
preparation and properties of steel-aggregate, for shielding, 16: 24231
LINEAR ACCELERATORS
design and operation for high-energy x-ray production, 16: 23976 (ANL-6515(p.218-47))
frequency control system for optimizing x-ray output of microwave electron, 16: 23952
LIPIDS
localization in granules in irradiated, leukemic, and normal, 16: 23447
radiation effects on metabolism in bone marrow and leukocytes, 16: 23415(R) (TID-16080)
LIPOPROTEINS
radiation effects on phosphorus content in microsomal, in rats, 16: 23450
LIQUID METAL COOLED REACTORS
core design for 500-Mw fast, 16: 24479
fuel evaluation for fast, 16: 24480
sodium for controller for, 16: 24952 (TID-15913)
LIQUIDS
neutron scattering by, 16: 24271 (AERE-R-4043)
neutron scattering, incoherent approximation for cross sections, 16: 24768(T) (AEC-tr-5158)
LITHIUM
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
proton reactions (p,n) at 3.25 to 13 Mev, cross sections and angular distributions, 16: 24817
LITHIUM BROMIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
LITHIUM CARBONATES
carbon exchange with potassium cyanide, 16: 23558
LITHIUM CHLORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
LITHIUM CHLORIDE–POTASSIUM CHLORIDE SYSTEMS
chemical and electrochemical properties of species, 16: 23675(T) (HW-tr-40)
LITHIUM FLUORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
radiation effects on color centers and lattice constant changes in, 16: 23766
LITHIUM FLUORIDE–POTASSIUM FLUORIDE–SODIUM FLUORIDE SYSTEMS
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
LITHIUM FLUORIDES
spectra, effects of isotopic composition on infrared absorption, 16: 23690
LITHIUM HYDRIDES
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
neutron spectra at low energies, 16: 24592
shielding properties, 16: 25031 (JPL-TR-32-232)
spectra, effects of isotopic composition on infrared absorption, 16: 23690
spectra, effects of isotopic composition on infrared absorption, 16: 23691
structure, pressure of polymorphic transition in, 16: 24205
thermal properties at 600 to 800°C, 16: 23670 (NP-11888)
LITHIUM IODIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
scintillation response to alphas and protons, 16: 23883
LITHIUM ISOTOPES Li-6
alpha stripping reactions (α,p), cross sections, 16: 24839
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
proton reactions (p,α), spectra of, 16: 23840 (CEA-2138)
reactions with carbon-12, angular distributions from, 16: 24851
synthesis in early history of solar system, 16: 24658
LITHIUM ISOTOPES Li-7
alpha stripping reactions (α,p), cross sections, 16: 24839
electron-spin-resonance spectra in rare-gas matrices at 4.2°K, 16: 23702
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
proton reactions (p,α), spectra of, 16: 23840 (CEA-2138)
proton reactions (p,n), neutron yields from, 16: 23964 (ANL-6515(p.9-27))
synthesis in early history of solar system, 16: 24658
LITHIUM ISOTOPES Li-9
decay at rest in emulsion, with hammer tracks, 16: 24827
LITHIUM–LITHIUM HYDRIDE SYSTEMS
thermal properties at 600 to 800°C, 16: 23670 (NP-11888)
LITHIUM–MAGNESIUM ALLOYS
phase transitions and tensile properties, 16: 24164 (NP-11778)
LITHIUM–MAGNESIUM–ZINC ALLOYS
phase transitions and tensile properties, 16: 24164 (NP-11778)
LITHIUM NIOBATE–SODIUM NIOBATE SYSTEMS
phase studies and electric properties, 16: 23687
LITHIUM OXIDES
diffusion of calcium, potassium, and sodium ions in, in melts with silicon oxide-sodium oxide systems, 16: 24038(T) (AEC-tr-5191)
LIVER
radiation effects on nucleoproteins in, 16: 23468
synthesis of creatine by, effects of whole-body irradiation, 16: 23463
vitamin B_{12} content and retention in dog, cobalt-60 labeled, 16: 23397 (BNL-4888)
LIVER DISEASES
diagnosis of hepatic vesicular affections with colloidal gold-198 and iodine-131-labeled Rose Bengal, 16: 23371 (CEA-1994)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
geology of region, 16: 25054 (TID-7628(p.248-81))
LUBRICANTS
bibliography on molybdenum disulfide, 16: 24167 (NP-11899)
development for high-temperature applications, survey, 16: 23802 (NP-11683)
development of radiation resistant, 16: 24247
LUBRICATION
book: *Gas Film Lubrication*, 16: 23813
effects of surface films, 16: 23803 (R60GL185)
of gyro bearing lubrication problems, tracer study, 16: 24582
LUMINESCENCE
review of radioactive, 16: 24055
LUMINESCENT DETECTORS
design and performance for π-σ resonance detection below 765 Mev, 16: 24748
LUMINESCENT MATERIALS
review of radioactive paints, 16: 24055
review of radioactive paints, 16: 24056
LUNGS
model, clearance and deposition properties, 16: 23382 (TID-7616 (p.133-46))
sorptive properties for plutonium oxide, 16: 23381 (TID-7616(p.127-32))
LUTETIUM HYDRIDES
structure, 16: 23683
LUTETIUM ISOTOPES Lu-175
energy levels and decay spectra, 16: 24806
energy levels and decay scheme, 16: 24808
LYMPH SYSTEM
effects of radiation sickness on function, 16: 23524
LYOMETALLURGY
development for separation of uranium from its ores, 16: 23770(R) (ACCO-17)

M

MAGNESIUM
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))

neutron cross sections at 0.025 ev to 18 Mev, 16: 24796 (UNC-5002)
separation from low-level wastes by precipitation, 16: 25036 (ORNL-TM-260)
sound propagation in solid-rod, 16: 23972 (ANL-6515(p.133-61))
MAGNESIUM CERIUM NITRATES
spin-lattice relaxation at 1 to 5°K, in fields up to 1 kOe, 16: 24313
MAGNESIUM ISOTOPES Mg-25
energy levels, hyperfine structure of metastable ^2P, 16: 24849
MAGNESIUM ISOTOPES Mg-28
yields in proton spallation of copper at 24 Bev, 16: 24859
MAGNESIUM NEODYMIUM NITRATES
spin-lattice relaxation at 1 to 5°K, in fields up to 1 kOe, 16: 24313
MAGNESIUM OXIDE COATINGS
electron secondary emission and scattering distributions, 16: 24335
MAGNESIUM OXIDE–SILICON OXIDE SYSTEMS
radiation effects of 1.2-Mev gammas at 70 to 400°F, 16: 24244 (TID-15981)
MAGNESIUM OXIDE–URANIUM OXIDE SYSTEMS
differential thermal analysis, 16: 23652
MAGNESIUM OXIDE–ZIRCONIUM OXIDE SYSTEMS
analysis, chemical, 16: 23599 (ARL-180)
MAGNESIUM OXIDES
stabilization of zirconium oxides with, effects of iron oxide on, 16: 24203
MAGNESIUM TITANATES
radiation effects on electric conductivity, slow-neutron, 16: 24266
MAGNETIC FIELDS
electron motions in, Bloch, 16: 24318
heating effects in theta pinch, 16: 24886 (CLM-R-19)
MAGNETIC MONOPOLES
interactions with electromagnetic fields, quantum theory, 16: 24927
MAGNETIC PROPERTIES
theory of galvano-, for anisotropic semiconductors, 16: 24331
MAGNETIC RESONANCE
ultrasonic cw spectrometer for studying electron spin-phonon interactions in solids, 16: 23950
MAGNETITE CONCRETES
economics and technology for shielding, 16: 24230
preparation and properties of steel-aggregate, for shielding, 16: 24231
MAGNETOHYDRODYNAMIC CELLS
development and performance, 16: 24884 (ASD-TDR-62-259)
electric current generation during plasma flow through a pipe, 16: 24902
kinetic energy transformation into electrical energy by isothermal damping in a transverse magnetic field, 16: 24901
MAGNETOHYDRODYNAMICS
fluid flow around plane plates in, incompressible, viscous, conducting, 16: 24894
hydromagnetic flow, exact solutions for two-dimensional, 16: 24887 (D1-82-0170)
wave propagation in infinite uniform plasma, 16: 24880 (AFCRL-896(Pt.II))
MAGNETOMETERS
design of electron spin resonance, for alternating magnetic fields, 16: 23947
design, operation and theory of rocket-borne, 16: 23836 (AFSWC-TDR-62-25)
MAGNETS
performance of large homopolar, at Canberra, 16: 24877
MAN
barium and strontium content in bones and diet, 16: 23370 (AERE-R-4035)
gamma doses from teletherapy, 16: 23399
radiation dosimetry and scattering in, 16: 24026
radiation effects on, genetic, 16: 23461
radiation effects on blood plasma proteins, 16: 23412 (CEA-2132)
radiation hazards from milk and water supplies contaminated by fall-out, 16: 24014 (NP-11715)
strain and stress relations of heat in, physiological indexes, 16: 23376 (TID-7616(p.61-8))
MANGANESE
determination in biological materials, activation, 16: 23403
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
neutron cross sections, corrections, 16: 24796 (UNC-5002)
MANGANESE BORIDES
electric conductivity, 16: 23662 (AE-76)
electronic structure, 16: 23662 (AE-76)
MANGANESE ISOTOPES Mn-51
yields in proton spallation of copper at 24 Bev, 16: 24859
MANGANESE ISOTOPES Mn-52
yields in proton spallation of copper at 24 Bev, 16: 24859
yields of metastable, in proton spallation of copper at 24 Bev, 16: 24859
MANGANESE ISOTOPES Mn-54
yields in proton spallation of copper at 24 Bev, 16: 24859
MANGANESE ISOTOPES Mn-56
yields in proton spallation of copper at 24 Bev, 16: 24859
MANGANESE OXIDE–SILICON OXIDE SYSTEMS
phase studies, 16: 24148(R) (ASD-TR-61-676)
MANGANESE–SILICON SYSTEMS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
MANGANESE SULFATES
neutron leakage from baths of, 16: 24432
MANNOSE
reactions with carbonyl reagents, carbon-14 and tritium isotope effects, 16: 23577
MARITIME PRESSURIZED WATER REACTOR
stability on N. S. Savannah, measurement by noise analysis, 16: 24539
MARITIME REACTORS
description of Lenin, 16: 25008
economic factors, comparison with oil fired ship power plants, 16: 24971 (CEND-150(Pt.I))
performance of Lenin during first voyage, 16: 25009
MASS SPECTROGRAPHY
development and use in reactor technology, 16: 23625 (TID-7629 (p.142-50))
MASS SPECTROMETERS
design and construction of high-frequency, 16: 23954
design of analyzer tube assemblies for, 16: 23857 (Y-1393)
MASS TRANSFER
in gases, interfacial rates for large gradients of concentration and temperature, 16: 23822 (NP-11818)
MATERIALS TESTING
activation analysis for, 16: 23964 (ANL-6515(p.9-27))
high-rotational-speed techniques for, 16: 24166 (NP-11854)
infrared techniques for, 16: 23973 (ANL- 6515(p.163-86))
nondestructive, conference on, 16: 23963 (ANL-6515)
radiographic techniques in, color, 16: 23975 (ANL-6515(p.203-17))
MATHEMATICS
computer program for least-squares or rational approximation of decay-type functions, 16: 24086 (ARL-229)
coördinate conditions from variational principles, 16: 24315
determination of components of the spin affine connection, 16: 24924
Yvon approximation method in neutron transport theory, 16: 24770
MECHANICAL DRIVES
design of fluid transmissions for, 16: 23800(R) (AD-269399)
MEDICINE
conference on science in the advancement of new states, Rehovoth, Israel, August 1960, German translation, 16: 23361
educational concepts in nuclear, 16: 23366 (BNL-4931)
MEMBRANES
diffusion of poly(butyl acrylate) across cellophane, tracer study, 16: 23563
MERCURY
binding to erythrocytes, tracer study, 16: 23393
determination in biological materials, activation, 16: 23403
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
solubility in organic solvents at 25°C, 16: 23591
MERCURY ISOTOPES Hg-203
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
MESIC ATOMS

decay of muons in iron and zinc, 16: 24819
mesons (μ^-) decay in, 16: 24278 (JINR-P-971)
MESONS
mass of vector, associated with Yang-Mills field theory, 16: 24729
model for description of, as bound-state particles, 16: 24722
MESONS (ϵ)
production in nucleon-antinucleon annihilation, selection rules, 16: 24735
MESONS (η)
production in nucleon-antinucleon annihilation, selection rules, 16: 24735
MESONS (K)
decay rates, comparison of $e + \nu$ and $\mu + \nu$, 16: 24700 (TID-16108)
interactions with mesons (π), meson (K^*) production in, 16: 24734
production in meson (π^-) interactions with protons at 16 Bev/c, 16: 24737
MESONS (K^-)
absorption in liquid hydrogen, 16: 24822
interactions with protons, angular distributions and cross sections, 16: 24701 (UCRL-10126)
interactions with protons at 62 to 172 Mev/c, cross sections, 16: 24704
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
MESONS (K^+)
interactions with deuterons in I = 0 state, charge-exchange, 16: 24727
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
MESONS (μ)
decay in iron and zinc, 16: 24819
photoproduction of e-μ pairs on nuclei at high energies, forbidden, 16: 24724
MESONS (μ^-)
beta decay parameters, 16: 24725
beta decay, rho value, 16: 24712
capture by nuclei, rates, 16: 24826
decay in copper, iron, nickel, and zinc mesic atoms, 16: 24278 (JINR-P-971)
emission by mesons (π^-), helicity in, 16: 24747
reactions with carbon-12, comparison of experiment and predictions of Universal Fermi Interaction, 16: 24788 (NP-11796)
scattering by lead, cross sections for Mott, 16: 24747
MESONS (μ^+)
emission by mesons (π^+), helicity in, 16: 24747
scattering by lead, cross sections for Mott, 16: 24747
MESONS (ω)
production in nucleon-antinucleon annihilation, selection rules, 16: 24735
MESONS (ω^0)
photoproduction on protons, computer values of, 16: 24680 (ISS-61/41)
MESONS (π)
asymmetry energy dependence in proton pair annihilation, 16: 24730
beta decay, conserved vector current theory of, 16: 24691 (JINR-P-968)
interactions, meson (ρ) production in, 16: 24734
interactions, two-pion-exchange approximation for, 16: 24723
interactions with mesons (π), poles in low energy scattering theory, 16: 24912 (AD-270903)
interactions with protons, scattering threshold anomalies, 16: 24690 (JINR-P-966)
interactions with nucleons at high energies, elastic cross sections, 16: 24721
interactions with mesons (K), meson (K^*) production in, 16: 24734
interactions with mesons (π^0), resonance properties from, 16: 24744
mass from nucleon-nucleon scattering, 16: 24692 (JINR-P-970)
production by high-energy electrons, 16: 24707
production in antiproton-proton interactions, resonances in, 16: 24750 (UCRL-9814)
production in hydrogen-meson (π^-) interactions at 16 Bev/c, 16: 24719
production in nucleon-antinucleon annihilation, selection rules for, 16: 24735
scattering in emulsions, multiple, 16: 24702
MESONS (π^-)
absorption in liquid hydrogen, 16: 24822
interactions with protons at 300 to 1600 Mev, total cross sections for, 16: 24677 (CEA-2136)
interactions with nuclear matter, nuclear emulsion studies, 16: 23850(R) (TID-16074)
interactions with helium at 153 Mev, angular distributions and cross sections, 16: 24682 (JINR-P-868)
interactions with nucleons, angular distribution, 16: 24682 (JINR-P-868)
interactions with protons at 7 to 8 Bev, mesons (π^0) production in, 16: 24685 (JINR-P-928)
interactions with gamma radiation, cross sections for, 16: 24695 (NP-11757)
interactions with protons, final state interactions in strange particle production, 16: 24711
interactions with nucleons at 7 Bev, inelastic low-multiplicity, 16: 24715
interactions with nucleons at 7 Bev, inelastic, 16: 24716
interactions with nucleons at 7.5 Bev, inelastic, 16: 24717
interactions with nucleons at 6.8 Bev/c, inelastic, 16: 24718
interactions with hydrogen at 16 Bev/c, meson (π) production, 16: 24719
interactions with protons at 16 Bev/c, hyperon (Λ^0) and (Σ) and meson (K) production in, 16: 24737
interactions with protons, 2-π resonances from, 16: 24744
interactions with protons at 775 and 871 Mev, meson (π) resonances below 765 Mev in, 16: 24748
interactions with mesons (π^0), resonance production below 765 Mev in, 16: 24748
meson (μ^-) emission and helicity from, 16: 24747
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
reactions with hydrogen at 1140 Mev, bubble chamber analysis, 16: 23850(R) (TID-16074)
reactions with hydrogen at 75 Mev, charge-exchange in, 16: 24689 (JINR-P-948)
reactions with xenon at 2.8 Bev, angular distribution and cross sections for, 16: 24695 (NP-11757)
scattering by nuclei, 16: 24682 (JINR-P-868)
MESONS (π^0)
decay and parity, 16: 24749
interactions with mesons (π^-), resonance properties from, 16: 24744
interactions with mesons (π^-), resonance production below 765 Mev in, 16: 24748
production from π^--meson reactions at 2.8 Bev, cross sections for, 16: 24695 (NP-11757)
production in (π^-) reactions with hydrogen at 75 Mev, 16: 24689 (JINR-P-948)
production in (π^--p) interactions at 7 to 8 Bev, 16: 24685 (JINR-P-928)
MESONS (π^+)
meson (μ^+) emission and helicity from, 16: 24747
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
scattering by carbon and oxygen at 87 Mev, angular distributions, 16: 24720
MESONS (ρ)
production in antiproton-proton interactions, 16: 24750 (UCRL-9814)
production in mesons (π) interactions, 16: 24734
production in nucleon-antinucleon annihilation, selection rules for, 16: 24735
MESONS (ζ)
production in nucleon-antinucleon annihilation, selection rules, 16: 24735
METAL COMPOUNDS
chemical and physical properties, research progress at Lawrence Radiation Lab., 16: 24175(R) (UCRL-10119)
radiation effects, bibliography on, 16: 24233 (57GL77)
METAL-FOIL DETECTORS
neutron activation perturbation, thermal, 16: 24363
neutron activation, effects of self-shielding and thickness on, 16: 24364
neutron flux depression by, Monte Carlo calculation of, 16: 24362
METALLIC FILMS
magnetic properties of very thin, 16: 24142 (AD-270673)
METALLURGY
research progress at Ames Laboratory, 16: 24108 (IS-351)

METALS
analysis for nitrides and oxides by high-temperature fluorination, 16: 23638 (TID-7629(p.295-307))
bibliography on light and refractory, 16: 24111 (NP-11825)
book: *Corrosion and Protection of Metal Construction Materials*, 16: 24129
deposition from metal halide vapor dissociation, 16: 24178(R) (WAL-TR-766-3/1-3)
fatigue, review of low-cycle, 16: 24172 (SSC-137)
heat transfer of liquid, development of facility for study of, 16: 24651
internal defect measurements using infrared inspection, 16: 23973 (ANL-6515(p.163-86))
mechanical properties at high temperatures, high-rotational-speed techniques for studying, 16: 24166 (NP-11854)
mechanical weakness during phase transformations, quantitative theory, 16: 24202
preparation and properties, 16: 24108 (IS-351)
pressure effects, bibliography and data on high-, 16: 24115
radiation effects, bibliography on, 16: 24233 (57GL77)
radiation effects on nonfissionable, bibliography on neutron, 16: 24269 (STI/PUB/21/6)
solubility, effects of ionization potential of atoms on mutual, 16: 24181(T) (AEC-tr-5177)
METALS (LIQUID)
heat transfer coefficients, 16: 23352(R) (BNL-705)
METEORITES
age estimation, radiometric, 16: 24007
analysis for argon isotope ratios, 16: 24668
analysis for cosmic-ray-induced carbon-14 and chlorine-36, 16: 23984 (NYO-8922)
primordial rare gas occurrence in, 16: 23998
rare gas occurrence in chondrite Tabor, primordial, 16: 23999
use in establishing intensity variations of cosmic radiation in last million years, 16: 24672
METHACRYLIC ACID
radioinduced graft polymerization on polyethylene fibers, 16: 24265
METHACRYLIC ACID, METHYL ESTER
radioinduced polymerization for Plexiglas production, 16: 24064
radioinduced polymerization with acrylonitrile, 16: 23739
METHACRYLIC ACID, METHYL ESTER POLYMERS
crosslinking degree of high-conversion methylene dimethacrylate copolymer, 16: 24196
diffusion of oxygen in, 16: 24195
production of Plexiglas by radiopolymerization, 16: 24064
radioinduced crosslinking, localized neutron, 16: 23720(T) (AEC-tr-5144)
radioinduced free radicals, thermal decomposition, 16: 23743
METHANE
carbon exchange with sorbed methane in molybdenum films, 16: 23576
electron diffusion in, at low energies, 16: 24325
radiolysis by fission products, 16: 24589
reactions with uranium to prepare uranium carbide, 16: 24168(R) (NYO-2694)
METHANE, IODO-
iodine exchange with iodine atoms in gaseous phase, 16: 23588
synthesis of iodine-labeled, 16: 23559
METHANES, HALO-
recoil atoms in bromine isotope containing, isotope effects and secondary reactions in (n,γ) processes, 16: 23723(T) (AEC-tr-5151)
METHIONINE
hydrolysis of S-adenosyl-, tracer studies of mechanism in alkaline solutions, 16: 23729
METHYLENE BLUE
radioinduced bleaching in aqueous solutions, effects of phenol concentration, 16: 23768
radiosynthesis, 16: 23708 (CEA-1991)
MICE
radiogenic convulsive seizures and low-level irradiation, 16: 23499
excretion of iron salts, 16: 23871
radiation effects on intercapillary glomerulosclerosis development in kidneys, gamma, 16: 23453
radiation effects, damage sequence in brain, 16: 23481
radiation effects on, protective effects of AET against, 16: 23517
tumor induction by strontium-90 injections, 16: 23464 (UAC-4763)
MICROORGANISMS
radiation resistance, 16: 24043
MICROSCOPES
design and performance of high-temperature, for observing radiometallic samples, 16: 23839 (CEA-2082)
MICROWAVE EQUIPMENT
design of frequency control system for optimizing x-ray output of microwave linear electron accelerator, 16: 23952
MICROWAVES
power measurements using in-line calorimeters, 16: 24068 (TID-16053)
transmission in plasma-filled waveguides in E_{01} mode, 16: 24093
MILK
analysis for strontium by gel filtration, 16: 23654
analysis for uranium, absorptiometric, 16: 23607 (PG-Report-187)
contamination by fall-out after nuclear attack, radiation hazards from, 16: 24014 (NP-11715)
iodine-131 content in Italian cities from Nov. 29 to Dec. 31, 1961, 16: 24024
radiation effects on bacteria in, 16: 23455
radioactivity in Milan, November and December 1961, 16: 24023
MINERALS
sorptive properties for radioisotopes in water, 16: 25035 (HW-69225)
MIT RESEARCH REACTOR
operating costs, 16: 24491
MITOCHONDRIA
protective effects against radiation damage in glutamic dehydrogenase, 16: 23456
MIXER-SETTLERS
development and uses, review, 16: 23793
MOLECULES
reactions of gaseous, with positive ions at 3×10^{-2} to 10^{3} ev, 16: 23725(T) (AEC-tr-5155)
vibrational force field of polyatomic, 16: 24300
MOLLUSKS
calcium, strontium, and strontium-90 content in Clinch and Tennessee River clams, 16: 23410 (ORNL-TM-270)
MOLTEN SALT REACTOR EXPERIMENT
development, 16: 25023(R) (ORNL-3282)
reactivity accidents, analysis of conceivable, 16: 24988 (ORNL-TM-251)
MOLYBDENUM
coatings for, 16: 24148(R) (ASD-TR-61-676)
critical surface temperature relations with cesium ion current, 16: 24280 (NASA-TN-D-1307)
determination in biological materials, activation, 16: 23403
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in plutonium using dithiol, spectrophotometric, 16: 23620 (TID-7629(p.62-8))
determination in uranium dioxide for burnup calculations, 16: 23626 (TID-7629(p.152-65))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
mechanical and physical properties at 4000 to 6000°F, 16: 24162 (NP-11654)
neutron scattering resonance cross sections for, fast, 16: 24387
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
radiation damage and recovery, point defects in neutron, 16: 24258
solubility in bismuth at 300 to 700°C, 16: 24216
specifications for sheet rolled, 16: 24160 (MAB-184-M)
welding, ultrasonic, 16: 24130(R) (AD-271377)
MOLYBDENUM ALLOYS
properties and liquid-phase sintering techniques for, 16: 24145 (ANL-6268)
specifications for sheet rolled, 16: 24160 (MAB-184-M)
welding, ultrasonic, 16: 24130(R) (AD-271377)
MOLYBDENUM CRYSTALS
strain-aging behavior, effects of annealing and impurities, 16: 24146 (ASD-TDR-62-11)
MOLYBDENUM FOILS
effects on carbon exchange between methane and sorbed methane,

16: 23576
MOLYBDENUM ISOTOPES
determination in irradiated fuels for burnup calculations, 16: 23627 (TID-7629(p.166-76))
MOLYBDENUM ISOTOPES Mo-94
energy levels and gamma spectra, 16: 24837
MOLYBDENUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
MOLYBDENUM–PLATINUM ALLOYS
phase studies, 16: 24185(T) (AERE-Trans-884)
MOLYBDENUM SILICIDE COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
MOLYBDENUM SULFIDES
bibliography on properties and uses as lubricant, 16: 24167 (NP-11899)
MOLYBDENUM–URANIUM ALLOYS
critical behavior of enriched unreflected unmoderated assembly, superprompt, 16: 24540
criticality studies, 16: 24419
exponential measurements in lattices with uranium carbide, 16: 24984 (NAA-SR-Memo-7134)
MOLYBDENUM–URANIUM ALLOYS (Zr CLAD)
meltdown studies of irradiated, 16: 24642
MONKEYS
effects of acute radiation sickness on reproduction, 16: 23522
radiation effects on nervous system, delayed effects, 16: 23483
MONTE CARLO METHOD
use for neutron penetration problems, useful techniques and their effectiveness, 16: 24605
MONTMORILLONITES
ion exchange properties, effects of heating, 16: 25048 (TID-7628(p.179-86))
MÖSSBAUER EFFECT
book: *The Mössbauer Effect*, 16: 24655
MULTIPLE SCLEROSIS
geographic distribution, 16: 23479
MULTIPLICATION FACTOR
determination from Monte Carlo calculations, 16: 24434
evaluation in critical and subcritical assemblies, 16: 24353
evaluation in critical and subcritical assemblies, 16: 24354
measurement, design of reactivity monitor for reactor startup, 16: 24546
neutron statistical behavior in multiplying media, 16: 24775
reactivity, measurement of dynamic temperature coefficients by forced oscillations in coolant flow, 16: 24542
MUTATIONS
radioinduced in plants, role in improvement of agricultural crops, 16: 23469
radioinduced in plants, role in improvement of agricultural crops, 16: 23369
radioinduced in wheat, 16: 23454

N

1-NAPHTHALDEHYDE
reactions with carbonyl reagents, carbon-14 and tritium isotope effects, 16: 23577
NAPHTHALENE
hydrogen isotope exchange with hydrobromic acid, 16: 23569
preparation of tritium-labeled, by electric discharge, 16: 23548
2-NAPHTHOL, 1-(2-PYRIDYLAZO)-
analytical use for determination of uranium, 16: 23600 (CNI-57)
NATIONAL REACTOR TESTING STATION
hydrology, 16: 25043 (TID-7628(p.99-114))
waste disposal, 16: 25043 (TID-7628(p.99-114))
waste disposal, practices and programs, 16: 25073 (TID-7628(p.536-68))
NAVAL VESSELS
design and nuclear performance of nuclear icebreaker Lenin, 16: 25008
performance of Lenin during first voyage, 16: 25009
NEODYMIUM
determination in uranium dioxide for burnup calculations, 16: 23626 (TID-7629(p.152-65))
separation from promethium by solvent extraction using di(2-ethyl-hexyl) orthophosphoric acid, 16: 23788 (ORNL-TM-184)
solubility in bismuth at 300 to 700°C, 16: 24216
NEODYMIUM HYDRIDES
magnetic moments, 16: 24173(R) (TID-15819)
NEON
electric conductivity decay measurements in plasma, 16: 24881 (AFCRL-1119)
properties as reactor coolant, 16: 23830 (BNL-5377)
NEON ISOTOPES Ne-19
positron helicity, 16: 24820
NEON ISOTOPES Ne-22
reactions (neon-22, 4n) with thorium-232, cross sections for, 16: 24781 (JINR-P-896)
NEPTUNIUM ISOTOPES Np-237
determination in human urine, evaluation of methods for, 16: 23375 (TID-7616(p.51-9))
NEPTUNIUM ISOTOPES Np-239
separation from water by adsorption on minerals, 16: 25035 (HW-69225)
NERVE CELLS
radiation effects in brain of rats, 16: 23474
radiation effects in embryonic neural tube, 16: 23476
radiation effects, survey, 16: 23480
radiation effects, high-dose gamma, 16: 23484
radiation effects of alpha particles from cyclotron, 16: 23492
radiation effects on spinal cord neurons, 16: 23502
radiation injuries, relation to proteolytic enzymes in cytoplasm, 16: 23494
NERVES
radiation effects on frog sciatic, deuteron and alpha, 16: 23486 (UCRL-9799)
radiation effects on bioelectric activity, 16: 23503
radiation effects of beta particles on compound action potentials, 16: 23504
NERVOUS SYSTEM
audiogenic convulsive seizures and low-level irradiation, 16: 23499
nucleic acid antimetabolite effects on cat, 16: 23478
radiation effects, review, 16: 24558
radiation effects on synapses, whole-body exposure, 16: 23442
radiation effects, conference, 16: 23471
radiation effects, 16: 23472
radiation effects, survey of gamma, beta, and x-radiation, 16: 23480
radiation effects of repeated low dose and single high dose, 16: 23482
radiation effects, demyelination, malacic myelopathy, and myodegeneration in monkeys and rats, 16: 23483
radiation effects, electron microscope study, 16: 23485
radiation effects, morphologic and pathophysiologic, survey of Russian work, 16: 23487
radiation effects of protons at 185 Mev, 16: 23489
radiation effects, functional changes, 16: 23497
radiation effects, review, 16: 23506
radiation effects on performance, head exposure in monkeys, 16: 23512
radiation effects in rats, 16: 23420 (USNRDL-TR-561)
radiation injuries, review of Soviet work, 16: 23496
radiation injuries, acute syndrome in burros, 16: 23498
radiosensitivity of blood vessel control, 16: 23438
role in changes of metabolic reactivity of irradiated organisms, 16: 23422(T) (AEC-tr-5190)
NEUROLOGY
use of accelerated ion beams in, 16: 23488
NEUTRINOS
emission in stars, theory, 16: 24659
interactions, two neutrino hypothesis, 16: 24694 (NP-11731)
scattering by electrons, two-body approximation of elastic, 16: 24688 (JINR-P-947)
NEUTRON CAPTURE CROSS SECTIONS
for monodirectional fission source, effective fast, 16: 24797 (WADC-TR-58-266)
NEUTRON CROSS SECTIONS
data from recent calculations and experiments, 16: 24776 (BNL-732)
fluctuations for 2- to 5-Mev neutrons, on nuclei with A near 30, 16: 24845
NEUTRON FISSION CROSS SECTIONS

calculation by multilevel formalism, simple approach to, 16: 24386
NEUTRON PHOTOGRAPHY
image converter materials and methods, comparisons of, 16: 23965 (ANL-6515(p.28-52))
image in, effects of detector characteristics and scattering on, 16: 23966 (ANL-6515(p.53-80))
NEUTRON RESONANCE CROSS SECTIONS
Doppler broadening, 16: 24393
NEUTRON SOURCES
calibration for intrinsic-trace process control, 16: 24570
multiplication factor for localized, 16: 24405
spectra of beryllium–polonium, 16: 24762 (TID-15743)
uses for material analysis evaluation, 16: 23964 (ANL-6515(p.9-27))
yields from polonium-, plutonium-, and radium-beryllium, 16: 24388
NEUTRON SPECTRA
calculation of above-thermal, 16: 24370
calculation of thermal, GATHER-II code for, 16: 24440
from deuterium breakup on deuterium, helium-4, and tritium, 16: 24821
measurement in lithium hydrides at low energies, 16: 24592
measurement with MIT fast chopper, 16: 24369
radiation damage dependence on, 16: 24636
radiation damage dependence on, 16: 24638
temperature coefficient in zirconium hydride, 16: 24380
temperature coefficient in zirconium hydride, 16: 24381
NEUTRON SPECTROMETERS
construction and calibration of long, 16: 23849 (TID-15746)
design and construction of single crystal, 16: 24650
performance of MIT fast chopper, 16: 24369
use for neutron radiography, 16: 23965 (ANL-6515(p.28-52))
NEUTRON SPECTROSCOPY
energy resolution and statistics in high-energy, sampling effects on, 16: 23934
NEUTRONS
absorption, ARES code for computing, 16: 24391
absorption by elements, for coefficients, 16: 23966 (ANL-6515(p.53-80))
absorption by materials with grain structure, 16: 24394
absorption by uranium and uranium oxide, resonance, 16: 24759 (AE-77)
absorption in composite cylinders, 16: 24760 (CRT-1079)
absorption in heterogeneous systems, Doppler broadened resonance, 16: 24439
absorption in reactors, spatial distribution of resonance, 16: 24392
absorption, theory of resonance, 16: 24390
angular distributions and energies from alpha reactions (α,n) with beryllium-9 at 4.3 to 5.6 Mev, 16: 24852
attenuation by bound moderators, 16: 24376
attenuation by concretes, 16: 24224
attenuation by heavy and light boron-poisoned water, 16: 24366
attenuation by heavy gases, 16: 24378
attenuation in concrete, effects of concrete composition, 16: 24908
computer program for solving multigroup, 16: 24763 (TRG-Report-229)
detection and measurement, design of fission chamber and preamplifier assembly for, 16: 24552
detection and measurement, design and performance of solid-state fission counters for, 16: 24553
detection and measurement, separation from gamma pulses, 16: 24579
detection and measurement in shelters during Upshot-Knothole tests 1 and 8, 16: 24016 (WT-789)
detection and measurement with scintillators, 16: 24327
detection and measurement, characteristics of scintillation systems for, 16: 23848 (SCTM-326-61(14))
detection and measurement, construction of long counter for, 16: 23849 (TID-15746)
detection and measurement by semiconductor detectors, 16: 23870
detection and measurement by aluminum and copper activation tapes, 16: 24904 (DC-61-2-98)
diffusion and thermalization in ice at −196°C and water at 0.5 to 286°C, 16: 24765(T) (AEC-tr-5143)
diffusion calculations, QUICKIE and ULCER programs for IBM-7090, 16: 24436
diffusion coefficients in heavy water at 20 to 220°C, 16: 24374
diffusion in iron-water shields, 16: 24597
diffusion in moderators, two-group boundary conditions in square lattices, 16: 24772
diffusion in solids, solution of equations for, 16: 23763
diffusion length calculations for, 16: 24373
diffusion lengths in bismuth-graphite systems and graphite, 16: 24375
diffusion, model study in Kansas State standard pile, 16: 24761 (TID-15667)
diffusion, transport corrections to, 16: 24371
distribution from TRIGA Reactor, 16: 25016 (DOFL-TM-60-27)
distribution from pulsed plane source, 16: 24758 (AE-71)
effects on brain in neutron capture therapy, 16: 23495
energy and flux distributions in Kansas University Reactor, 16: 25025 (TID-15977)
energy spectra and flux measurements in reactors, methods for, 16: 23377 (TID-7615(p.69-77))
energy spectra, effects of reflection from homogeneous, slowing-down half space, 16: 24773
flux calculations, refinements in two-group, 16: 24401
flux calculations, computer program for two-group current-equivalent parameters in, 16: 24930 (AE-75)
flux depression by metal foils, Monte Carlo calculation of, 16: 24362
flux distribution in reactor, shape of, 16: 25004(T) (AERE-Trans-888)
flux measurements with metal foils, effects of self-shielding and thickness on, 16: 24364
flux measurements, effects of detectors on, 16: 24365
flux measurements in tissue-equivalent phantoms, 16: 23460 (AERE-R-3696)
flux perturbation by gold foils, 16: 24359
flux synthesis approximations in the time direction, 16: 24543
interactions with protons at 200 Mev, 16: 24684 (JINR-P-920)
interactions with protons at 310 Mev, phase shift analysis, 16: 24687 (JINR-P-944)
interactions with protons, scattering phase shift analysis, 16: 24692 (JINR-P-970)
interactions with protons at 0.5 and 3.2 Mev, total cross sections, 16: 24706
lethal effects on grasshopper embryos, 16: 23413 (TID-15962)
neutron flux measurements, design of fission chamber and preamplifier assembly for, 16: 24552
production in reactions (α,n) on beryllium-9, angular distributions, 16: 24804
propagation in media, measurement, 16: 23814(P)
radiation effects on nonfissionable alloys and metals, bibliography on, 16: 24269 (STI/PUB/21/6)
reactions (n,γ) with nuclei, isotopic effect of secondary reactions of recoil atoms in, 16: 24861
reactions on crystalline solids at high energies, theory for damage, 16: 24256
reactions with antimony, arsenic, selenium, and tellurium at 0.003 to 0.008 ev, total cross sections, 16: 24811
reactions with hydrogen, proton recoil energy loss distribution from, 16: 24791 (ORNL-3089)
reactions with uranium-235, effects of neutron energy on energy of fission products from, 16: 24809
reactivity worth of fission, in fast reactors, 16: 24398
resonance absorption by uranium-238 in lattices and rods, 16: 24764 (WAPD-T-1497)
resonance reactions, statistical errors in flux level parameters in, 16: 24771
scattering by liquids, 16: 24271 (AERE-R-4043)
scattering by simple metal-transition metal alloys, cross sections for magnetic, 16: 24333
slowing down in Dowtherm A at 10 to 260°C, 16: 24774
slowing down, model study in Kansas State standard pile, 16: 24761 (TID-15667)
slowing-down spectrum, computer program for calculation, 16: 24945 (MND-C-2500-5)
statistical behavior in multiplying media, 16: 24775
thermalization, relation of real and imaginary parts of Van Hove correlation function for describing, 16: 24766(T) (AEC-tr-5146)
transmission through slab of liquid hydrogen calculation by Monte Carlo method, 16: 24605
transport, generalized variational method for calculating, 16: 24372

transport theory, analytical solution for energy-dependent problem in, 16: 24769(T) (AEC-tr-5204)
transport, Yvon approximation method in, 16: 24770
use to produce high concentrations of vacancies in crystalline solids, 16: 24309
yields from beams, beam energies and target thickness effects, 16: 23964 (ANL-6515(p.9-27))
NEVADA PROVING GROUNDS
tunnel U12e, properties of tuff specimens from, 16: 23987 (TEI-811)
tunnels at, geology of U12k and U12k.01, 16: 23988 (TEI-817)
NEW ZEALAND
fallout monitoring, 16: 23408(R) (DXRL-F3)
NICKEL
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
determination in niobium and zirconium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
electric conductivity, 16: 23662 (AE-76)
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
mesic atoms of, meson (μ^-) decay in, 16: 24278 (JINR-P-971)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
properties as reactor reflector, 16: 24421
reactor reflector critical thickness, 16: 24410
separation from aqueous solutions by mixer-settlers, review, 16: 23793
separation from cerium and chromium, 16: 23658
surface friction in sliding on nickel, effects of surface films, 16: 23803 (R60GL185)
NICKEL ALLOYS
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
NICKEL ISOTOPES Ni-57
yields in proton spallation of copper at 24 Bev, 16: 24859
NICKEL ISOTOPES Ni-58
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
NICKEL ISOTOPES Ni-60
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
NICKEL ISOTOPES Ni-62
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
NICKEL ISOTOPES Ni-64
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
NICKEL ISOTOPES Ni-65
yields in proton spallation of copper at 24 Bev, 16: 24859
NICKEL–NIOBIUM–TITANIUM ALLOYS
properties of MAR-Aging steels, 16: 24153 (DMIC-Memo-156)
NICKEL OXIDES
reactor reflector critical thickness, 16: 24410
NIOBIUM
analysis for 23 elements by neutron activation, 16: 23633 (TID-7629 (p.239-44))
coatings for, 16: 24148(R) (ASD-TR-61-676)
corrosion by chloride solutions, 16: 23528(R) (ORNL-3290)
critical surface temperature relations with cesium ion current, 16: 24280 (NASA-TN-D-1307)
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
determination using thiocyanic acid, spectrophotometric, 16: 23659
electric conductivity at 4°K, 16: 24888(R) (NBS-7244)
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
radiation damage, point defects in neutron, 16: 24258
separation of fission product, radiochemical, 16: 24564
specifications for sheet rolled, 16: 24160 (MAB-184-M)
NIOBIUM ALLOYS
corrosion by acids at high temperature, 16: 24129
specifications for sheet rolled, 16: 24160 (MAB-184-M)
NIOBIUM CHLORIDES
reactions with potassium chloride, tracer study of gaseous, 16: 23709 (JINR-P-957)
NIOBIUM COMPOUNDS
preparation and properties of heteropoly acid containing molybdate, 16: 23680
NIOBIUM ISOTOPES Nb-94
beta and gamma spectra, from ground and 42-kev states, 16: 24837
NIOBIUM ISOTOPES Nb-95
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
separation from nitric acid solutions by solvent extraction with TBP, 16: 23787 (ORNL-3285)
NIOBIUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
NIOBIUM–TANTALUM–VANADIUM ALLOYS
coating with aluminum–silicon in tin, 16: 24163(R) (NP-11711)
coating with ceramics and metals, 16: 24148(R) (ASD-TR-61-676)
NIOBIUM–TIN ALLOYS
electric conductivity, magnetic effects, 16: 24888(R) (NBS-7244)
NIOBIUM–TUNGSTEN–ZIRCONIUM ALLOYS
properties for alkali metal containment, 16: 24165(R) (NP-11824)
NIOBIUM–URANIUM ALLOYS
properties as fuel alloy at high temperatures, 16: 24633
NIOBIUM–ZIRCONIUM ALLOYS
fabrication of beta-quenched, 16: 24137
NITRATES
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
solvent properties for stainless steel, 16: 23783 (IDO-14584)
NITRIC ACID
electrolytic effects on sedimentation rate of uranium (IV–VI) oxide suspensions, 16: 23699
partition between aqueous and tributyl phosphate–hexane phase, 16: 24646
properties as eluant for inorganic ion chromatography on zirconium phosphate paper, 16: 23650
separation from sodium nitrate aqueous solutions by solvent extraction using trilaurylamine, 16: 23791 (TID-16139)
solvent extraction by tributyl phosphate, mechanism, 16: 23797
solvent properties for stainless steel, 16: 23787 (IDO-14584)
solvent properties for uranium, 16: 23536
NITRIDES
determination in metals and salts by high-temperature fluorination, 16: 23638 (TID-7629(p.295-307))
NITROGEN
determination in boron–silicon systems, 16: 23599 (ARL-180)
effects on heat transfer in Santowax R, 16: 23820 (NAA-SR-6891)
electron diffusion and mobility in, 16: 24281 (NP-11846)
electron diffusion in, at low energies, 16: 24325
hatchability effects on Habrobracon eggs in first meiotic metaphase, post-irradiation, 16: 23452
ion-neutral reactions in afterglows, 16: 24276 (GA-2824)
ionization by metastable helium atoms, cross sections, 16: 24296
neutron cross sections at 0.025 ev to 18 Mev, 16: 24796 (UNC-5002)
neutron inelastic removal cross sections, 16: 24408
properties as reactor coolant, 16: 23830 (BNL-5377)
sorption by materials, pore volume determination by, 16: 23641 (TID-7629(p.345-56))
thermodynamic properties, graphs and tables, 16: 23664 (ASD-TR-61-625)
NITROGEN ISOTOPES
separation during production of concentrated nitric acid by direct methods, 16: 24079
NITROGEN ISOTOPES N-14
deuteron elastic scattering and reactions (d,p) at 27 Mev, 16: 24831
deuteron reactions (d,p) at 2 Mev, stripping analysis, 16: 24841
gamma reactions (γ,n), (γ,p), and (γ,np), cross sections, 16: 24834
neutron reactions (n,p) in crystalline solids, distribution of carbon-14 from, 16: 23734
reactions with platinum-198 at 60 to 110 Mev, products from, 16: 24854 (UCRL-9950)
structure, from lithium-6 reactions with carbon-12, 16: 24851
NITROGEN ISOTOPES N-15
synthesis in early history of solar system, 16: 24658
NITROGEN ISOTOPES N-16
specific activity, evaluation by diffusion calculations, 16: 24590
NITROGEN OXIDES
formation in neutron-irradiated liquid air, 16: 24587
NITROGEN–OXYGEN SYSTEMS

ion-neutral reactions in afterglows, 16: 24276 (GA-2824)
NITROSYL COMPOUNDS
structure of $K_4Mn(CN)_5NO$, 16: 23570
NPD REACTOR
operation from startup to fuel equilibrium, computer simulation, 16: 24932 (CRRP-1087)
NUCLEAR ELECTRIC MOMENTS
quadrupole coupling constants in alkali halide crystals, 16: 24654
NUCLEAR EMULSIONS
charged particle scattering in, multiple, 16: 24702
distortion in, effects on measurements at high momenta, 16: 24718
energy resolution and statistics for neutron, 16: 23934
proton energy-range relationship in Agfa-K2, 16: 23859(T) (CEA-tr-A-1119)
NUCLEAR MAGNETIC MOMENTS
quadrupole coupling constants in alkali halide crystals, 16: 24654
NUCLEAR MAGNETIC RESONANCE
equipment for detecting, 16: 23962(P)
equipment for well logging, 16: 23961(P)
NUCLEAR MODELS
review of Elliott model, 16: 24825
NUCLEAR MODELS (DROP)
deformation energies and fission behavior in, 16: 24803
NUCLEAR PHYSICS
development of theoretical, Brown University summary, 16: 23850(R) (TID-16074)
experiments, testing of electronic systems for, 16: 23918 (UCRL-9982)
research programs in low-energy, summary for Penn State University, 16: 24794(R) (TID-15211)
transactions of the American Nuclear Society 1962 Meeting, Boston, 16: 24338
NUCLEAR POWER
economics in Europe, 16: 23360
growth in Canada and U. S., 16: 24978 (DL-49)
NUCLEAR POWER PLANTS
cost factors, guide for estimating, 16: 24990 (TID-7025(Vol.1))
cost factors of buildings, improvements, and land, guide for estimating, 16: 24991 (TID-7025(Vol.2))
cost factors of equipment, guide for estimating, 16: 24992 (TID-7025 (Vol.3))
cost factors of fuel in, guide for estimating, 16: 24993 (TID-7025(Vol.4))
cost factors of power production in, guide for estimating, 16: 24994 (TID-7025(Vol.5))
safety, 16: 25010
steam pressurizer surge tank behavior, 16: 24503
NUCLEAR REACTIONS
mechanism of direct and resonance, 16: 24799(T) (AEC-tr-5160)
peripheral model for (p,d), far above 1 Bev, 16: 24843
potential scattering, with complex angular momentum and energy, 16: 24310
research progress, 16: 24699(R) (TID-15820)
spin-orbit splitting and tensor force, 16: 24829
vertex function kinematic structure of, Lorentz transformations in, 16: 24860
NUCLEAR SPIN
fission resonance width effects, 16: 24348
NUCLEAR TECHNOLOGY
conference on analytical chemistry in nuclear reactor technology, Gatlinburg, Tenn., October 10 to 12,1961, 16: 23613 (TID-7629)
NUCLEAR THEORY
nuclear forces, effects of charge, 16: 24301
transport coefficients, microscopic determination, 16: 24921
triton, matrix elements of quadratic LS operator in, 16: 24833
NUCLEI
bremsstrahlung scattering, resonant, 16: 24703
electron and positron scattering cross sections, 16: 24863
electron inelastic scattering, single-particle excitations, 16: 24825
electron reactions with alkali halide crystal, double-resonance spectrum for hyperfine F-center, 16: 24317
electron scattering, form factors for elastic and inelastic, 16: 24862
field interactions, iteration method for neutral scalar, 16: 24847
gamma reactions at high energies, forbidden e-μ pair production, 16: 24724
meson (μ^-) capture rates, 16: 24826
meson (π^-) scattering in, 16: 24682 (JINR-P-868)
model for deformation and fission, drop, 16: 24803
neutron reactions at 2 to 5 Mev, cross section fluctuations near A = 30, 16: 24845
neutron reactions (n,γ), isotopic effect of secondary reactions of recoil atoms in, 16: 24861
nuclear forces, effects of charge, 16: 24301
polarization, based on gamma scattering amplitude, 16: 24782 (JINR-P-967)
proton reactions far above 1 Bev, peripheral model, 16: 24843
spin-orbit splitting and tensor force, 16: 24829
vibrations of spheroidal even-even, octupole, 16: 24302
NUCLEI (CELLS)
radioinduced decomposition of globulin, histone, and nucleic acids in, 16: 23468
NUCLEONS
interactions, dispersion relation electrostatic corrections for, 16: 24751
interactions with mesons (π^-), angular distribution, 16: 24682 (JINR-P-868)
interactions with nucleons, phase shifts for scattering, 16: 24708
interactions with mesons (π^-) at 7 Bev, inelastic low-multiplicity, 16: 24715
interactions with mesons (π^-) at 7 Bev, inelastic, 16: 24716
interactions with mesons (π^-) at 7.5 Bev, inelastic, 16: 24717
interactions with mesons (π^-) at 6.8 Bev/c, inelastic, 16: 24718
interactions with mesons (π) and nucleons at high energies, elastic cross sections, 16: 24721
interactions with antinucleons, selection rules for integral-isospin meson production in, 16: 24735
magnetic moments from strange-particle interactions at high energies, 16: 24739
polarization, based on gamma scattering amplitude, 16: 24782 (JINR-P-967)
reactions with nuclei in photographic emulsions at 10^{11} ev, 16: 24662 (PAN-291/VI)
scattering by nucleons, theory of non-local effects, 16: 24794(R) (TID-15211)
NUCLEOPROTEINS
radiation effects in lymphatic and parenchymatous tissues, 16: 23468

O

OAK RIDGE NATIONAL LAB., TENN.
papers, publications, and reports for 1961, 16: 23355 (ORNL-3300 (Vol.1))
waste disposal, facilities for land burial, 16: 25064 (TID-7628(p.437-59))
waste disposal, ground storage, 16: 25070 (TID-7628(p.506-12))
waste disposal, ground storage, 16: 25071 (TID-7628(p.513-31))
OCTYLAMINE
solvent properties for rare earths and transuranic elements, 16: 24344
OILS
radioinduced oxidation of crude, on industrial scale, 16: 23751
ONIONS
radiation effects, 16: 24044
ORGANIC ACIDS
synthesis of carbon-14-labeled, equipment, 16: 23531
ORGANIC COMPOUNDS
preparation of carbon-14-labeled, 16: 23552
preparation of tritium-labeled, by electric discharge, 16: 23548
preparation of tritium-labeled, by electric discharge, 16: 23551
radiation effects, bibliography on, 16: 24233 (57GL77)
radioinduced alkylation of aromatics in the gas phase, 16: 24588
radioinduced polymerization, survey, 16: 23727
ORGANIC-COOLED DEUTERIUM REACTOR
development status, 16: 24452
economic analysis, 16: 24453
ORGANIC COOLED REACTORS
coolant decomposition and makeup costs, 16: 24457
coolant processing, 16: 24462
design of ESSOR test facility for ORGEL, 16: 24451
design of ORGEL, 16: 24450

development review, 16: 24449
fuel element development, 16: 24463
fuel element development for ORGEL, 16: 24464
heat transfer surface fouling in, 16: 24459
ORGANIC MODERATED REACTORS
components, fabrication methods and materials for, 16: 24149(R) (BMI-X-204)
development in Italy, 16: 24454
heat transfer, hydraulic, and other core parameters, effects of core length, 16: 24946 (NAA-SR-Memo-4325(Rev.1))
ORNL FAST BURST REACTOR
criticality studies, 16: 24949 (ORNL-TM-189)
ORNL HIGH FLUX ISOTOPE REACTOR
design, 16: 24341
neutron decay constants for, prompt, 16: 24423
transuranium elements preparation in, 16: 23528(R) (ORNL-3290)
OSMIUM COMPLEXES
decomposition of bromo-, effects of bromine-80m isomeric transitions in, 16: 23764
OXALACETIC ACID
enolization, effects of water-d_2, 16: 23532
OXETANES
radioinduced polymerization of 3,3-bischloromethyl, 16: 23744
OXIDES
determination in metals and salts by high-temperature fluorination, 16: 23638 (TID-7629(p.295-307))
OXYGEN
determination in boron–silicon systems, 16: 23599 (ARL-180)
determination in pure and environmental waters, radiometric, 16: 24577
determination of dissolved, in boiler feed water, 16: 23610 (PG-Report-335)
diffusion in methyl methacrylate polymer and polycarbonate resin, 16: 24195
ion-neutral reactions in afterglows, 16: 24276 (GA-2824)
ionization by metastable helium atoms, cross sections, 16: 24296
neutron cross sections, corrections, 16: 24796 (UNC-5002)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
radiosensitivity effects on plants, 16: 23451
radiosensitivity effect on skin, 16: 23466
radiosensitivity effects on immature germ cells of *Drosophila virilis*, 16: 23470
reactions with graphite, 16: 23678
reactions with sulfur dioxide on platinum catalyst, kinetics, 16: 23584
thermodynamic properties, graphs and tables, 16: 23664 (ASD-TR-61-625)
OXYGEN IONS
hydrogen reactions, cross sections for charge transfer, 16: 24780 (GA-2783)
transition probabilities for VI spectral lines, 16: 24285(R) (TID-16127)
OXYGEN ISOTOPES O-16
gamma reactions (γ,n) at 31 Mev, neutron energy spectra and yields from, 16: 24864
meson (π^+) scattering at 87 Mev, angular distributions, 16: 24720
neutron scattering resonance cross sections for, fast, 16: 24387
proton elastic scattering at 2.0 to 8.6 Mev, differential cross sections, 16: 24823
reactions (oxygen-16, 4n), cross sections for, 16: 24781 (JINR-P-896)
OXYGEN ISOTOPES O-17
volatility effects on water, 16: 23667 (IA-728)
OXYGEN ISOTOPES O-18
volatility effects on water, 16: 23667 (IA-728)
OXYGEN–WATER SYSTEMS
radiolysis of system with sodium hydroxide and sodium sulfite, hydrogen yield in, 16: 23716 (PAN-290/ChR)

P

PAINTS
review of radioactive luminous, 16: 24055
review of radioactive luminous, 16: 24056
PAIR PRODUCTION
lepton, forbidden photoproduction of e-μ pairs on nuclei, 16: 24724
PALLADIUM
solubility in bismuth at 300 to 700°C, 16: 24216
PALMITIC ACID
preparation of tritium-labeled, by electric discharge, 16: 23548
PARAFFIN
neutron fluxes in, thermal, 16: 23964 (ANL-6515(p.9-27))
PARAMAGNETIC MATERIALS
hypersonic wave detection and generation in, 16: 23970 (ANL-6515(p.117-20))
PARAMECIUM
growth on blood serum from irradiated animals, effects of drugs, 16: 23440
PARTICLE TRACKS
photographic recording of bubble chamber, computer analysis, 16: 24087 (BNL-725)
PARTICLES
reactions on crystalline solids at high energies, theory for damage, 16: 24256
PEACH BOTTOM POWER REACTOR
fuel element fabrication procedure, 16: 24119 (GAMD-2221)
neutron streaming in, 16: 24596
shutdown mechanisms, 16: 24519
PEAT
adsorptive properties for zirconium and ruthenium, 16: 25078
PENTANE, 2,2,4-TRIMETHYL-
cyclization of carbon-14-labeled, catalytic, 16: 23565
solvent properties for mercury, 16: 23591
PENTANES
radiolysis, 16: 23587
PERCHLORIC ACID
properties as eluant for inorganic ion chromatography on zirconium phosphate paper, 16: 23650
PERSONNEL
urinary uranium study on plant, 16: 23380 (TID-7616(p.99-100))
PETROLEUM
flow, use of radioisotopes in control of, 16: 24057
properties of fractions as organic coolants, 16: 25018(R) (IDO-16761(p.1-74))
PHAGOCYTIN
bactericidal activity, effects of whole-body irradiation, 16: 23462
PHANTOMS
applications of tissue-equivalent, in neutron flux measurements, 16: 23460 (AERE-R-3696)
radiation dosimetry and scattering in, 16: 24026
relative biological effectiveness of gamma and x rays in tissue-equivalent, 16: 23448
PHARMACEUTICALS
analysis for antimony and arsenic, activation, 16: 23646
PHENAZINE DYES
radiosensitivity effects on polyphenyls, 16: 25018(R) (IDO-16761(p.1-74))
PHENOL, DINITRO-
effects on ultraviolet-irradiated *E. coli*, 16: 23449
PHENOLS
chemical effects on radioinduced bleaching of methylene blue solutions, 16: 23768
PHOSPHONATES
solvent properties of dibutyl butyl-, for uranium leach ion exchange nitrate eluants, 16: 23774 (NP-11877)
PHOSPHONIC ACID, DERIVATIVES
solvent properties for zirconium, 16: 23660
PHOSPHONIC ACIDS
2-ethylhexyl phenyl-, solvent properties for transuranic elements, 16: 24345
PHOSPHORIC ACID, ALKYL ESTERS
solvent properties for neodymium and promethium, 16: 23788 (ORNL-TM-184)
PHOSPHORS
background gamma radiation in Hornyak buttons, cancelation, 16: 23916 (UAC-6092)
efficiency of organic liquid, 16: 23884

properties and use, review, 16: 24291
properties and uses of liquid organic, in scintillation detectors, 16: 24337
response to heavy particles, effects of delta rays, 16: 23880
review of alkali halide crystals, 16: 23877
scintillation response to neutrons, 16: 24327
PHOSPHORUS
determination in human hair, radiochemical, 16: 23379 (TID-7616 (p.89-97))
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
movement in peppermint plant, 16: 23389
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
radiation effects on content in microsomal lipoproteins in rats, 16: 23450
PHOSPHORUS ISOTOPES P-29
energy levels from silicon (p,p) reactions at 4.8 to 7.0 Mev, 16: 24795 (TID-15331)
PHOSPHORUS ISOTOPES P-31
neutron reactions at 2 to 5 Mev, cross section fluctuations, 16: 24845
PHOSPHORUS ISOTOPES P-32
accumulation in trees, use in studying soil contamination, 16: 23406 (CEA-2131)
analysis for impurities, activation, 16: 23649
content in rainfall at Westwood, N. J., 16: 23985 (NYO-9532)
distribution of implanted grains, in organs, glands, and tissues, 16: 23365
effects on survival of rats and mice receiving subsequent lethal doses of x radiation, 16: 23443
separation from water by adsorption on minerals, 16: 25035 (HW-69225)
tracer use for determination of scandium as pyrophosphate, 16: 23726
tracer use for measurement of sand and silt drift on Portugal seacoasts, 16: 24005
yields in proton spallation of copper at 24 Bev, 16: 24859
PHOSPHORUS ISOTOPES P-33
yields in proton spallation of copper at 24 Bev, 16: 24859
PHOTODEUTERONS
production on nuclei, at 30 to 90 Mev, 16: 24835
PHOTOELECTRIC EFFECT
determination of cross sections and polarization effects, 16: 24294
mechanism, under x irradiation, 16: 24328
PHOTOGRAPHIC EMULSIONS
cosmic secondary nucleon reactions with nuclei in, 16: 24662 (PAN-291/VI)
development process for, reversal, 16: 23669 (NP-11826)
preparation, latest image study of roll of gelatin in, 16: 23967 (ANL-6515(p.81-6))
sensitivity calibration, 16: 23847 (SCTM-16-62(11))
PHOTOGRAPHIC FILM
performance of Agfa Texo-F, for gamma radiography, 16: 23977
sensitivity, contrast and definition effects on radiographic, 16: 23969 (ANL-6515(p.102-15))
X-ray, characteristic curves for depicting subject features in, 16: 23968 (ANL-6515(p.87-101))
PHOTOGRAPHIC FILM DETECTORS
developing with monobath fixer-developer, 16: 23869
dosimetry with, advantages and basic principles of gamma and x, 16: 24028
performance for beta dosimetry, 16: 23378 (TID-7616(p.79-88))
PHOTOGRAPHY
image formation and uses, latent, 16: 23967 (ANL-6515(p.81-6))
PHOTOMULTIPLIER TUBES
design, fabrication, and use, 16: 23863
design of fast-response, 16: 23864
development for nuclear physics, 16: 23886
development for scintillation counting, 16: 23887
development, review, 16: 23885
developments, 16: 23888
performance, 16: 23920
performance of fast-response, 16: 23865
response to single photoelectron inputs, 16: 23893 (UCRL-9980)
PHOTONEUTRONS
production cross sections for, 16: 24778 (CEA-2148)
production in infinite medium of heavy water by delayed gammas following uranium-235 irradiation, 16: 24495
yields from bremsstrahlung reactions with carbon and oxygen at 3/Mev, 16: 24864
PHOTONS
interactions with deuterons, disintegration Landau-curve secodes for, 16: 24738
PHOTOPROTONS
production on nuclei, at 30 to 90 Mev, 16: 24835
PHYSICAL CHEMISTRY
use of radioisotopes in studies of two-phase equilibria, 16: 23580
use of radioisotopes in studies of complex equilibria, 16: 23583
PHYSICS
conference on science in the advancement of new states, Rehovoth, Israel, August 1960, German translation, 16: 23361
physical properties of inorganic materials, research at Lawrence Radiation Lab., 16: 24175(R) (UCRL-10119)
research progress at Ames Laboratory, July 1, 1960 to June 30, 1961, 16: 24277(R) (IS-349)
wave equation for non-uniform medium, 16: 24917(T) (UCRL-Trans-796(L))
PHYSIOLOGY
indexes in strain and stress relations of heat, 16: 23376 (TID-7616 (p.61-8))
PIPES
radiography of French gas mains, 16: 24060
PIQUA POWER REACTOR
core development and fabrication, 16: 24465
PISTON ENGINES
design of steam-operated, for submarine use, 16: 23798 (AD-269390)
PITUITARY GLAND
radioinduced ablation, effectiveness of phosphorus-32 grains, 16: 23365
PLANARIA
radiosensitivity of, effects of decapitation, 16: 23414 (TID-15984)
PLANTS
analysis for uranium in herbaceous, absorptiometric, 16: 23606 (PG-Report-188)
analysis for uranium alpha activity by precipitation, 16: 23596 (AERE-R-3499)
movement of radioisotopes in peppermint, 16: 23389
nutrition studies with radioisotopes, conference summary, 16: 23392
radiation effects, factors affecting, 16: 23451
radioinduced mutations, role in improvement of agricultural crops, 16: 23469
radioinduced mutations, role in improvement of agricultural crops, 16: 23369
PLASMA
acceleration by crossed electrostatic and magnetic fields, 16: 24885 (ASD-TR-61-283)
bremsstrahlung relation to friction in, 16: 24898
Cherenkov radiation by particles in, anomalous Doppler effect, 16: 24897
electric current generations during flow through a pipe, 16: 24902
electromagnetic wave propagation in, nonlinear kinetics of, 16: 24899
energy transfer in helium, 16: 24891(R) (RADC-TN-61-222)
heating in theta pinch, numerical calculations of effects of trapped magnetic fields, 16: 24886 (CLM-R-19)
hydromagnetic flow, exact solutions for two-dimensional, 16: 24887 (D1-82-0170)
injection by Lorentz force, 16: 24446
interaction of fully ionized with line currents, 16: 24656 (ML-879)
interactions with plane electromagnetic waves in magnetic fields, 16: 24308
interactions with electromagnetic fields, conductivity decay measurements, 16: 24881 (AFCRL-1119)
kinetic energy transformation into electrical energy by isothermal damping in a transverse magnetic field, 16: 24901
mathematical analysis, 16: 24443
microwave transmission in waveguides containing, in E_{01} mode, 16: 24893
models, relation between orbit and transport, 16: 24892
motion due to static magnetic interactions in, random phase approximation

of collective, 16: 24883 (ARL-251)
oscillations, in theory of electron energy losses in metals, 16: 24329
production by opposition of pinched hydrogen ion beams with electron injection, 16: 24895
production, generator for, 16: 24879 (AEDC-TDR-62-88)
production with associated temperature of 1.5 billion °K, 16: 24896
reactions with geomagnetic field, 16: 24657 (R62SD30)
stability of non-Maxwellian homogeneous, method for calculation of electrostatic, 16: 24900
wave propagation in infinite uniform, 16: 24880 (AFCRL-896(Pt.II))
PLASMA JETS
for hypersonic wind tunnel, 16: 24885 (ASD-TR-61-283)
production, gas discharge apparatus for, 16: 23815(P)
spreading characteristics of argon, 16: 24879 (AEDC-TDR-62-88)
temperatures, determination by photographic emulsions, 16: 23847 (SCTM-16-62(11))
PLASTIC COATINGS
radiation effects on lacquer, 16: 24263
PLASTIC DEFORMATION
theory for metals, quantitative, 16: 24202
PLASTIC FILMS
preparation for beta counting, 16: 23939
PLASTICS
degradation and fracture, bibliography, 16: 24112 (PLASTEC-NOTE-2)
radiation effects on properties of 6-nylon fibers, 16: 24264
PLATES
film removal by ultrasonic vibrations, 16: 25018(R) (IDO-16761(p.1-74))
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
PLATINUM
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
PLATINUM COMPLEXES
acid hydrolysis and chlorine exchange of trans-dichlorodiammine(II), 16: 23681
decomposition of bromo-, effects of bromine-80m isomeric transitions in, 16: 23764
PLATINUM ELECTRODES
sorptive properties for iodine-131, 16: 24085
PLATINUM ISOTOPES Pt-198
nitrogen-14 reactions at 60 to 110 Mev, products from, 16: 24854 (UCRL-9950)
PLOWSHARE PROJECT
earth deformation from a nuclear detonation in salt, 16: 23357 (PNE-109F)
postshot radiation and temperature studies of Gnome event, 16: 23356 (PNE-106F)
PLUMBBOB OPERATION
Smoky shot, effects on French shelters, 16: 24019 (WT-1453)
PLUTONIUM
analysis data, use of computer programs in preparation and reporting of routine, 16: 23630 (TID-7629(p.193-208))
analysis for molybdenum and tungsten by spectrophotometric method using dithiol, 16: 23620 (TID-7629(p.62-8))
burnup determination by analysis for fission products, 16: 23628 (TID-7629(p.177-83))
criticality studies, 16: 24417
determination in irradiated fuel elements by gamma-excited x-ray spectra, 16: 24352
determination of specific activity of pile-produced by measurement of plutonium-238 content, 16: 23629 (TID-7629(p.185-92))
economics as power reactor fuel, 16: 24483
percolation through soils, 16: 25054 (TID-7628(p.248-81))
preparation of high-density, high-purity, electrorefining processes for, 16: 24109 (LA-2666)
reclamation facility shielding required for NPR materials, 16: 23780 (HW-68021)
separation from uranium by solvent extraction, 16: 23794
tissue retention, effectiveness of various chelating agents on removal, 16: 23396
PLUTONIUM CARBIDE–URANIUM CARBIDE SYSTEMS
properties as reactor fuel, 16: 24480
PLUTONIUM CHLORIDES
properties for use as fuel in fast breeder reactors, 16: 25002(T) (AEC-tr-5161)
PLUTONIUM ISOTOPES Pu-238
determination in pile-produced plutonium, 16: 23629 (TID-7629(p.185-92))
PLUTONIUM ISOTOPES Pu-239
neutron cross sections, 2200-m/sec, 16: 24383
neutron multiplication, 16: 24431
reactor criticality effects, 16: 24407
reactor criticality effects, 16: 24408
spectra, isotope shifts in infrared emission, 16: 24336
PLUTONIUM ISOTOPES Pu-240
spectra, isotope shifts in infrared emission, 16: 24336
PLUTONIUM ISOTOPES Pu-241
carbon-13 reactions (carbon-13, 4n), cross sections for, 16: 24781 (JINR-P-896)
PLUTONIUM NITRATES
criticality studies, 16: 24416
PLUTONIUM OXIDE–URANIUM OXIDE SYSTEMS
properties as reactor fuel, 16: 24480
PLUTONIUM OXIDES
exposures in field and laboratory, enigma, 16: 23381 (TID-7616(p.127-32))
sorption by bone and lung, 16: 23381 (TID-7616(p.127-32))
PLUTONIUM RECYCLE TEST REACTOR
control characteristics, 16: 24537
fuel element radiation stability, 16: 24640
POLONIUM COMPOUNDS
synthesis of organic, by beta decay of bismuth-210, 16: 23721(T) (AEC-tr-5149)
POLONIUM ISOTOPES Po-208
fission-spallation competition in, 16: 24854 (UCRL-9950)
POLONIUM ISOTOPES Po-210
alpha spectra, 16: 23840 (CEA-2138)
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
production of carrier-free, electrolytic, 16: 24083
recoil distributions and ranges from alpha reactions (α,n) and (α,2n) with lead-207 and 208 at 19.7 to 37.2 Mev, 16: 24853 (UCRL-9595-Rev.II)
POLONIUM ISOTOPES Po-211
fission-spallation competition in, 16: 24854 (UCRL-9950)
POLYMERIZATION
kinetic equations for vinyl, 16: 23738
radioinduced ionic, 16: 23749
radioinduced, mechanisms, 16: 23545
radioinduced, of organic compounds, 16: 23727
POLYMERS
diffusion of argon and helium in, radiation effects, 16: 24268
diffusion of iodine and oxygen in polycarbonate resin, 16: 24195
radiation chemistry, survey, 16: 23748
radiation effects on fibers, 16: 24249
radiation effects on mechanical properties of fibers, 16: 24250
radiation effects on mechanical properties of tire cord, 16: 24262
radiation effects on lacquer coatings, 16: 24263
radiation effects, 16: 23727
radiation effects, review, 16: 23752
POLYPHENYLS
flow and heat transfer, loop for studying, 16: 24460
processing irradiated, 16: 24462
radiation effects, 16: 25018(R) (IDO-16761(p.1-74))
POPULATIONS
radiation effects, genetic, 16: 24559
PORCELAIN ENAMELS
incorporation of fission products in for use as beta sources, 16: 24698(R) (RAI-201)
PORES
measurement in materials by nitrogen adsorption-desorption studies, 16: 23641 (TID-7629(p.345-56))
PORTLAND CEMENTS
properties, 16: 24227
shielding properties around low-power heavy water reactors, 16: 25036
POSITRONS
annihilation reactions with electrons in inelastic scattering on nuclei,

cross sections, 16: 24863
detection and measurement in space, detectors for, 16: 23924
emission from potassium-40, 16: 24856
POTASSIUM
determination in glasses, radiological, 16: 23656
determination, radiochemical, 16: 23647
neutron cross sections at 0.025 ev to 18 Mev, 16: 24796 (UNC-5002)
properties of liquid, as reactor coolant, 16: 23830 (BNL-S377)
self-diffusion in melts containing silica and sodium oxide, lithium oxide, calcium oxide, and potassium oxide, 16: 24038(T) (AEC-tr-5191)
POTASSIUM BROMIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
POTASSIUM CARBONATES
carbon exchange with potassium cyanide, 16: 23558
POTASSIUM CHLORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
radioinduced F-center formation in calcium-doped, analytical expression for, 16: 23765
structure, pressure of polymorphic transition in, 16: 24205
POTASSIUM CHLORIDE–RUBIDIUM CHLORIDE SYSTEMS
diffusion of rubidium ions in, 16: 23692
POTASSIUM CHLORIDES
reactions with gaseous hafnium, niobium, tantalum, and zirconium chlorides, tracer study, 16: 23709 (JINR-P-957)
POTASSIUM CYANIDES
preparation of carbon-14-labeled, by carbon exchange with carbonates, 16: 23558
POTASSIUM FLUORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
POTASSIUM HYDROXIDES
electrolytic effects on sedimentation rate of uranium (IV–VI) oxide suspensions, 16: 23699
POTASSIUM IODIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
scintillation properties of thallium activated, effects of crystal temperature and thallium content, 16: 23956
scintillation response to alphas and protons, 16: 23883
POTASSIUM ISOTOPES K-39
electron-spin-resonance spectra in rare-gas matrices at 4.2°K, 16: 23702
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
POTASSIUM ISOTOPES K-40
positron emission, 16: 24856
POTASSIUM ISOTOPES K-42
yields in proton spallation of copper at 24 Bev, 16: 24859
POTASSIUM ISOTOPES K-43
yields in proton spallation of copper at 24 Bev, 16: 24859
POTASSIUM OXIDES
diffusion of calcium, potassium, and sodium ions in, in melts with silicon oxide-sodium oxide systems, 16: 24038(T) (AEC-tr-5191)
POTASSIUM–SODIUM ALLOYS
properties of liquid, as reactor coolant, 16: 23830 (BNL-S377)
POTASSIUM SODIUM TARTRATES
radiation effects on electromechanical and dielectric properties, gamma, 16: 24267
POTASSIUM SULFATES
sulfur exchange with sulfur gas and sulfur dioxide, 16: 23574
POTASSIUM SULFITES
sulfur exchange with sulfur dioxide, 16: 23574
POTATOES
radiation effects, 16: 24044
radioinduced inhibition of sprouting, feasibility in United Kingdom, 16: 23411 (AERE-R-3977)
POWDER METALLURGY
development for aerospace use, 16: 24110(R) (MAB-139-M(C4))
POWER BREEDER REACTORS
fuel cycle studies for fast, 16: 24484
POWER REACTORS
control rod economics for light water moderated, 16: 24485
coolant input temperature, determination of optimum, 16: 25005
coolant temperatures, calculation of reheating temperature in double circuit design, 16: 25006
design of ESSOR test facility for ORGEL, 16: 24451
design of ORGEL, 16: 24450
design parameters for gas-cooled, 16: 25007
development of settled-bed, 16: 24481
development problems, review, 16: 25012
development status and potential of small, 16: 24476
fuel element development, 16: 24463
fuel element development for ORGEL, 16: 24464
fuel element production, survey of recent developments, 16: 24113
fuel element testing for pebble-bed, 16: 24627
fuel values of plutonium and uranium-233 for, 16: 24483
hydrodynamics of uranium dioxide suspension in homogeneous, 16: 25003(T) (AEC-tr-5198)
shielding calculations, 16: 24593
POWER SUPPLIES
design of high-voltage, for radiation measuring devices, 16: 23945
PRASEODYMIUM
solubility in bismuth at 300 to 700°C, 16: 24216
PRASEODYMIUM HYDRIDES
electric conductivity, 16: 23683
magnetic moments, 16: 24173(R) (TID-15819)
PRESSURE
effects on solids, bibliography and data on high-, 16: 24115
PRESSURE DROP
in flow across tube bank in heat exchanger, 16: 23826
in wet steam flowing in round tubes, 16: 23816 (EURAEC-42)
measurement for NCR flow range, 16: 23819 (KAPL-M-WAG-1)
PRESSURE TRANSMITTERS
radiation effects, gamma and neutron, 16: 24554
PRESSURE VESSELS
cyclic testing of large, 16: 23807 (TID-15979)
design and cost for high temperature gas cooled reactors, 16: 24489
materials, survey of properties of steel as, 16: 24215
PRESSURIZED WATER REACTORS
control and reactivity transients, 16: 24532
coolant superheat cycle for, 16: 24475
criticality studies of small-diameter, 16: 24413
decontamination, development of procedure for, 16: 24939 (HW-SA-2548)
development, 16: 24998(R) (WAPD-MRP-97)
heat transfer in, determination of boundary of local boiling region, 16: 24509
PRESSURIZERS
surge tank behavior, 16: 24503
PROMETHIUM
separation by electrolytic reduction, 16: 23578
separation by ion exchange and elution with alpha-hydroxy acids, 16: 25371
separation from neodymium by solvent extraction using di(2-ethyl-hexyl) orthophosphoric acid, 16: 23788 (ORNL-TM-184)
PROMETHIUM ISOTOPES Pm-147
gamma emission, 16: 24583
separation from americium-241 and other fission products by ion exchange, 16: 23786 (ORNL-3271)
PROPANE
radiolysis, absolute hydrogen yields in gamma, 16: 23730
reactions with uranium to prepare uranium carbide, 16: 24168(R) (NYO-2694)
vibration coordinates and frequencies of deuterated and normal, 16: 23668 (IDO-16769)
PROPANE, 2-AMINO-1,1-DIPHENYL-
deamination, mechanism, 16: 23564
PROPANE, 2-METHYL-
radiation effects of x rays at 300 kv, 16: 23714(R) (NYO-10023)
radiolysis, absolute hydrogen yields in gamma, 16: 23730
1,3-PROPANEDIONE, 1,3-DIPHENYL-
analytical use for determination of uranium in aqueous effluents, 16: 23605 (PG-Report-186)
analytical use for absorptiometric determination of uranium, 16: 23606 (PG-Report-188)
2-PROPANOL

decomposition kinetics, 16: 23568
2-PROPANOL, 1-AMINO-1,2-DIPHENYL-
deamination, mechanism, 16: 23564
2-PROPANOL, 1-AMINO-1-PHENYL-2-p-TOLYL-
deamination, mechanism, 16: 23564
PROPENE
radiation effects of x rays at 300 kv in isobutane mixtures, 16: 23714(R) (NYO-10023)
radiolysis, absolute hydrogen yields in gamma, 16: 23730
PROPENE, 2-METHYL-
radioinduced polymerization with styrene, 16: 23760
radioinduced polymerization, mechanism, 16: 23545
PROPENE, 2-METHYL- POLYMERS
radiolysis, 16: 23745
PROPENE POLYMERS
radiation effects on dynamic mechanical properties, 16: 24253
radiation effects on thermal stability of fibers, 16: 24255
PROPULSION
electric, review of developments in, 16: 25030 (AFOSR-1632)
PROTACTINIUM ISOTOPES Pa-231
separation from uranium-232, 16: 23528(R) (ORNL-3290)
PROTACTINIUM ISOTOPES Pa-233
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
PROTACTINIUM ISOTOPES Pa-234
beta dose measurements, methods for, 16: 23378 (TID-7616(p.79-88))
PROTEINS
polarographic activity of blood serum, during radiation sickness, 16: 23516(T) (JPRS-13639)
radiation effects on plasma, in man, 16: 23412 (CEA-2132)
PROTON BEAMS
properties of 10-Bev, 16: 24871(T) (UCRL-Trans-843)
PROTON SHIELDING
electrostatic fields as, 16: 24903 (ASD-TDR-62-244)
PROTON SPECTROMETERS
design for use in space, 16: 23928
development for measuring energy spectra and flux of protons in Van Allen belts and interplanetary space, 16: 23832 (AD-269867)
PROTONS
angular distribution from direct nuclear photoeffect, 16: 24800(T) (UCRL-Trans-828(L))
angular distributions from alpha reactions (α,p) with aluminum-27 at 4 Mev, 16: 24828
effects on brain at 185 Mev, 16: 23489
energy-range relationship in Agfa-K2 nuclear emulsions, 16: 23859(T) (CEA-tr-A-1119)
interactions with mesons (π^-) at 300 to 1600 Mev, total cross sections for, 16: 24677 (CEA-2136)
interactions with gamma rays, computer values of mesons (π^0) photoproduction in, 16: 24680 (ISS-61/41)
interactions with neutrons at 200 Mev, 16: 24684 (JINR-P-920)
interactions with mesons (π^-) at 7 to 8 Bev, mesons (π^0) production in, 16: 24685 (JINR-P-928)
interactions with neutrons and protons at 310 Mev, phase shift analysis, 16: 24687 (JINR-P-944)
interactions with mesons (π), scattering threshold anomalies, 16: 24690 (JINR-P-966)
interactions with neutrons and protons, scattering phase shift analysis, 16: 24692 (JINR-P-970)
interactions with mesons (K^-), angular distributions and cross sections from, 16: 24701 (UCRL-10126)
interactions with mesons (K^-) at 62 to 172 Mev/c, cross sections, 16: 24704
interactions with neutrons at 0.5 and 3.2 Mev, total cross sections, 16: 24706
interactions with electrons at high energies, meson (π) production in, 16: 24707
interactions with electrons, theory of bremsstrahlung and pion production processes, 16: 24709
interactions with hyperons (Λ) at 1.15 Bev/c, elastic scattering cross section, 16: 24710
interactions with mesons (π^-), final state interactions in strange particle production, 16: 24711
interactions with antiprotons, meson (π) asymmetry energy dependence in, 16: 24730
interactions with mesons (π^-) at 16 Bev/c, hyperon (Λ^0) and (Σ) and meson (K) production in, 16: 24737
interactions with antiprotons at high energies, radius lower limit calculation for, 16: 24740
interactions with mesons (π^-), 2-π resonances from, 16: 24744
interactions with mesons (π^+) at 775 and 871 Mev, meson (π) resonances below 765 Mev in, 16: 24748
interactions with antiprotons, meson (π) resonances from, 16: 24750 (UCRL-9814)
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
polarization, estimation of magnetic, 16: 24782 (JINR-P-967)
reactions on nuclei far above 1 Bev, peripheral model, 16: 24843
reactions with aluminum and beryllium at 30 and 33 Bev, charged-particle production in, 16: 24858
reactions with hydrogen, cross sections for charge transfer, 16: 24780 (GA-2783)
recoil energy losses from neutron irradiation of hydrogen, 16: 24791 (ORNL-3089)
scattering in emulsions, multiple, 16: 24702
spallation of copper at 24 Bev, yields from, 16: 24859
PSEUDOUREA, 2-(2-AMINOETHYL)-2-THIO-
protective effects against radiation in neonatal rats, 16: 23508
protective effects against radiation in mice, 16: 23517
PUERTO RICO POWER REACTOR
critical experiments at zero power, 16: 24981 (GNEC-198)
PULSE ANALYZERS
design and construction for grey-wedge gamma spectroscopy, 16: 23951
design and utilization of multichannel selectors with magnetic memory, 16: 23943
design of preselectors, 16: 23845 (NP-11734)
review, 16: 23873
review of multichannel, 16: 23911 (BNL-5993)
PULSES
multiplication of fast voltage, by logarithmic attenuator, 16: 23917
PUREX PROCESS
flowsheet for preparation of phosphate glass, 16: 23352(R) (BNL-705)
PYRIMIDINES
effects of fluorinated, on central nervous system of cat, 16: 23478
PYRITES
separation from water-fluidized coal, tracer study, 16: 24035(R) (NYO-9851)
PYROCATECHOL
biological activity of eye, effects of radiation sickness, 16: 23439

Q

QUANTUM ELECTRODYNAMICS
Dirac trace calculation, computer program, 16: 24922
gage invariance effects on spectral representations, 16: 24923
lectures on, 16: 24915 (NP-11612(Vol.II))
quantization, formulation using no potentials, 16: 24918
spin affine connection components, determination, 16: 24924
spin affine connection in, defining equation with arbitrary γ_5 value, 16: 24926
spinning particle analysis in, effects of Thomas precession, 16: 24925
theory of relativistic invariance, 16: 24794(R) (TID-15211)
theory using magnetic monopoles, with no potentials, 16: 24927
QUANTUM MECHANICS
exciton Bose-Einstein excitation, 16: 24320
programming and variational principles of classical and statistical, dynamic, 16: 24295
scalar particle, Newton-Wigner coordinate for, 16: 24686 (JINR-P-939)
scattering equation, formulation of nonlinear singular integral Low, 16: 24913 (JINR-P-890)
scattering equation, operators connected with nonlinear singular integral Low, 16: 24914 (JINR-P-901)
statistical theory for free space in, 16: 24920
symmetry properties of S-matrix with application to resonance reactions,

16: 24916 (NP-11738)
QUARTZ
drift measurement in Denmark using chromium-51, 16: 23995
hypersonic wave attenuation in, 16: 23970 (ANL-6515(p.117-20))
radiation effects of 1.2-Mev gammas at 70 to 400°F, 16: 24244 (TID-15981)
radioinduced crosslinking with teflon, localized neutron, 16: 23720(T) (AEC-tr-5144)
radioinduced luminescence, 16: 23754
QUINONES
reactions with methylcyclohexane and toluene to form complexes, 16: 23533

R

RABBITS
antimony-124 distribution and excretion in, 16: 23386 (UR-608)
radiation effects on central nervous system, 16: 23482
radiation effects on brain, comparison of sensitivity of various parts, 16: 23421(T) (AEC-tr-5141)
radiation effects on metabolic reactivity, role of nervous system in, 16: 23422(T) (AEC-tr-5190)
RADAR
use in fallout prediction, 16: 23405(R) (AD-269884)
RADIATION
biological and medical effects, review, 16: 24556
biological and medical effects, 16: 23418 (TID-16219)
biological effects, survey, 16: 24557
biological effects on nervous system, review, 16: 24558
biological effects on yeasts, 16: 24043
biological effects, target theory, 16: 23458
biological effects on metabolic reactivity of chickens, rabbits, and rats, role of nervous systems in, 16: 23422(T) (AEC-tr-5190)
book: *Radiation Analysis Methods and Devices*, 16: 23959
dispersion in atmosphere, graphs for estimating, 16: 23986 (ORO-545)
effects of sublethal dose, behavioral and hematologic studies, 16: 23511
effects on behavior, cranial exposure, 16: 23509
effects on behavior, conditioning studies, 16: 23510
effects on blood picture, 16: 23434 (BNL-6011)
effects on central nervous system and on behavior, 16: 23506
effects on embryos and fetuses, 16: 23472
effects on food, survey, 16: 24039
effects on foods, 16: 24044
effects on granulocyte lipids, 16: 23447
effects on learning in neonatal rats, 16: 23508
effects on lipid metabolism in bone marrow and leukocytes, 16: 23415(R) (TID-16080)
effects on metabolism in tumor tissues, 16: 23367
effects on nervous system, conference, 16: 23471
effects on performance in monkeys, head exposure, 16: 23512
effects on plants, factors affecting, 16: 23451
effects on psychologic processes in monkeys, 16: 23514
effects on skin photoceptors in frogs, 16: 23444
effects on spinal cord neurons, 16: 23502
genetic effects, review, 16: 24559
hazards in space conquest, biological and medical aspects of, 16: 23432
lethal effects on insects, review, 16: 24053
scattering of unpolarized, by polarized electron, 16: 24922
somatic effects, review, 16: 24560
RADIATION CHEMISTRY
alkylation of aromatic compounds in the gas phase, 16: 24588
conference on development, 16: 23711 (JLI-650-2-1(Vol.II))
of fluorocarbons and fluorocarbon polymers, 16: 23707 (ARL-62-350)
of high polymers, 16: 23748
training experiments in, Vol. 1, 16: 23710 (JLI-650-2-1(Vol.I))
training experiments in, Vol. 2, theory, 16: 23711 (JLI-650-2-1 (Vol.II))
RADIATION DAMAGE
dose rate dependence in reactor spectra, 16: 24636
in solids and reactor materials, conference summary, 16: 24251
spectral dependence of neutron, 16: 24638
statistical theory, for high-energy particles on crystalline solids, 16: 24256
RADIATION DETECTION INSTRUMENTS
book: *Radiation Analysis Methods and Devices*, 16: 23959
description of measuring equipment for gamma spectroscopy, 16: 23946
design and performance of solid-state fission counters, 16: 24553
design for high-energy cosmic gamma rays, 16: 23929
design for water monitoring, 16: 23868
design of fission chamber and preamplifier assembly for high-flux reactors, 16: 24552
design of particle spectrometers for satellites and space probes, 16: 23922
design of radio-photoluminescent dosimeter, 16: 23960(P)
design of radiochromatogram scanner, 16: 23940
performance in measurements in shelters in Upshot-Knothole operation, 16: 24016 (WT-789)
power supplies, design of high-voltage, 16: 23945
review, 16: 23874
review of transistorized, 16: 23955
RADIATION DETECTION INSTRUMENTS (COLORIMETRIC)
gamma response of ferrous sulfate dosimeter, effects of formic acid, 16: 23732
gamma response of ammonium ferrous sulfate solutions, 16: 23735
RADIATION DETECTION INSTRUMENTS (ION CURRENT TYPE)
design of low-frequency wave analyzer for spectral density measurement of reactor power oscillations, 16: 24549
RADIATION DETECTION INSTRUMENTS (PULSE TYPE)
book: *Electronic Counting Apparatus for Nuclear Radiation*, in German, 16: 23957
calibration of Geiger-Mueller counters, 16: 23833 (AEET/AM/24)
RADIATION DETECTORS
design and uses of direction gamma, for medical diagnoses, 16: 23941
review, 16: 23872
RADIATION EFFECTS
bibliography, 16: 24233 (57GL77)
bibliography, 16: 24242 (NP-11856)
bibliography, 16: 24269 (STI/PUB/21/6)
on electronic components, bibliography on, 16: 24241 (NP-11852)
on kinetic processes, theory, 16: 23755
on polymeric fibers, 16: 24249
on polymers, 16: 23752
RADIATION EXPOSURE CHAMBERS
design for studying neutron propagation in media, 16: 23814(P)
RADIATION INJURIES
acute nervous syndrome in burros, 16: 23498
audiogenic convulsive seizures in mice, 16: 23499
delayed, in monkeys, 16: 23522
delayed, in newborn rats, 16: 23523
diagnosis, by measurement of rate of blood plasma iron metabolism, tracer method, 16: 23430
effects on toxicity of blood serum for paramecium, 16: 23440
genetic effects in humans, 16: 23461
reaction mechanisms, target theory, 16: 23458
therapy using bone marrow injections, etiology of secondary disease, 16: 23521
to brain, detection using fluorescein dye, 16: 23491
to central nervous system, review of Soviet work, 16: 23496
to nerve cells, relation to proteolytic enzymes in cytoplasm, 16: 23494
to nervous system, 16: 23497
RADIATION MONITORING
of solidified high-level wastes, 16: 25039 (TID-7628(p.9-12))
RADIATION PROTECTION
book: *Protection Against Roentgen and Gamma Rays*, 16: 24034
RADIATION SICKNESS
blood serum protein polarographic activity during, 16: 23516(T) (JPRS-13639)
effects on biological activity of catecholamine of eye, 16: 23439
effects on cutaneous blood vessels and skin temperature, 16: 23518
effects on histology of intestinal cells, 16: 23519
effects on lymph system and skeletal joints, 16: 23524
effects on reproductive system in monkeys, 16: 23522
oöcyte maturation division during, 16: 23520

pathological effects, delayed, in newborn rats, 16: 23523
treatment with bone marrow injections, 16: 23525
RADIATION SOURCES
dose absorbed by cylindrical, effects of shielding, 16: 24909
industrial, survey of capacities and costs, 16: 24046
industrial use, review, 16: 24050
RADIATION TARGETS
neutron yields from heavy ice and titanium–tritium, 16: 23964 (ANL-6515 (p.9-27))
RADIOACTIVE MATERIALS
characterization of gas-borne, by a diffusion cell technique, 16: 24648
inspection using high-level gamma spectrometer system, 16: 24555
RADIOACTIVITY
monitoring airborne, at Hanford Plant area, 16: 23983 (CEX-59.4.11)
RADIOAUTOGRAPHY
techniques of reversal-development process, 16: 23669 (NP-11826)
RADIOBIOLOGY
conference on response of nervous system to radiation, 16: 23471
mechanisms of biological effects of radiation, 16: 23423(T) (AEC-tr-5215)
relation of vision research to, 16: 23500
RADIOCHEMICAL PROCESSING PLANTS
radiation and radioisotopes in, survey, 16: 23728
survey of water requirements, 16: 23790 (ORNL-TM-244)
RADIOCHEMISTRY
development of analytical techniques in, 16: 23352(R) (BNL-705)
methods at Veszprem, Hungary, 16: 23726(T) (JPRS-14324)
production of very heavy elements, 16: 24339
RADIODIAGNOSIS
equipment for, direction gamma, 16: 23941
of kidney disease, use of mercury-203-labeled chlormerodrin, 16: 23400
RADIOGRAPHY
image formation and uses, latest, 16: 23967 (ANL-6515(p.81-6))
of French gas pipelines, 16: 24060
of shipbuilding materials, 16: 24067
of welded steel plate joints for flaws, 16: 24058
safety requirements for industrial, using radioisotopes, 16: 24029
sensitivity, contrast and definition effects on, 16: 23969 (ANL-6515(p. 102-16))
sensitivity improvement with, radiopaque penetrant, 16: 23978
technique for low-voltage, of thin sections, 16: 23980
techniques and uses of color, 16: 23975 (ANL-6515(p.203-17))
use of fine-grain film for gamma, 16: 23977
use of radioisotopes to locate defects, 16: 24066
use of ytterbium-169 in, 16: 24584
x-ray film, characteristic curves for predicting subject features, 16: 23968 (ANL-6515(p.87-101))
RADIOISOTOPES
accumulation in trees, use in studying soil contamination, 16: 23406 (CEA-2131)
book: *Radioactive Tracers in Chemistry and Industry*, 16: 24072(T)
book: *Radioisotopes*, 16: 24073
book: *What Isotopes Offer Us*, 16: 24074
conference, 16: 23547
conference on, Japan, October 1961, abstracts and program for, 16: 23354 (NP-11767)
decay and growth from neutron bombardment, 16: 23964 (ANL-6515(p.9-27))
development, 16: 23352(R) (BNL-705)
dispersion in soil, hydrodynamic factors, 16: 25042 (TID-7628(p.77-98))
distribution in New Zealand milk and rainwater, 16: 24012(R) (HASL-127)
industrial use, review, 16: 24050
industrial use, review, 16: 24051
production and use in Belgium, 16: 24049
production by intermittent irradiations, activation measurements of, 16: 23712 (NP-11744)
safety requirements for industrial use in radiography, 16: 24029
sorption on soil, 16: 25048 (TID-7628(p.179-86))
transport through porous media, 16: 25055 (TID-7628(p.303-23))
use in automation of papermaking processes, 16: 24077
use in chemical and petroleum industry, 16: 24047
use in iron and steel industry, 16: 24031
use in petroleum industry, 16: 24069
use in radiography of French gas pipelines, 16: 24060
use in radiography of defects, 16: 24066
use in radiography of shipbuilding materials, 16: 24067
use in soil-plant nutrition studies, conference summary, 16: 23392
use in studies of two-phase equilibria, 16: 23580
use in studies of complex equilibria, 16: 23583
use in Veszprem, Hungary radiochemical laboratory, 16: 23726(T) (JPRS-14324)
RADIOLOGICAL DEFENSE
training course, 16: 24653
RADIOMETERS
design and performance for measuring thermal radiation from atomic explosions, 16: 23854 (WT-543)
RADIOMETRIC ANALYSIS
errors in uranium assaying in field by, 16: 23992
review, 16: 24562
review of radioreagent techniques, 16: 24575
RADIOSENSITIVITY
effects of previous administration of radioisotopes on, in mice and rats, 16: 23443
of bacteria in nutritious and non-nutritious media, effects of antibiotics, 16: 23425
of brain of newborn rats, 16: 23475
of *Drosophila virilis* immature germ cells, effects of oxygen on, 16: 23470
of *E. coli*, effects of physical conditions, 16: 23426
of gonads in mice, 16: 23436
of Planaria, effects of decapitation, 16: 23414 (TID-15984)
of skin, effects of oxygen tension, 16: 23466
of skin photoceptors in frogs, 16: 23444
of yeasts, 16: 24043
RADIOSTERILIZATION
of cacarboxylase hydrochloride, 16: 23424
of food and drugs, 16: 24052
of foods, 16: 24045
of foods, microbiological problems, 16: 24042
of packaged fish and beef, 16: 24036(T) (AEC-tr-5096)
of potatoes and vegetables, 16: 24059
RADIOTHERAPY
dosimetry studies, 16: 23399
review, 16: 24561
RADIUM
separation from thorium, 16: 23373 (TID-7616(p.3-38))
RADIUM ISOTOPES Ra-224
separation from barium salts, effects of radium-228 decay scheme on, 16: 23990(T) (AEC-tr-5159)
RADIUM ISOTOPES Ra-226
alpha reactions (α,4n) at 32.9 to 46.2 Mev, angular distributions and maps from, 16: 24853 (UCRL-9595-Rev.11)
charged particle fission, energetics of, 16: 24350
determination in uranium mill effluents, 16: 23383 (TID-7616(p.147-75))
separation from barium salts, effects of radium-228 decay scheme on, 16: 23990(T) (AEC-tr-5159)
RADIUM ISOTOPES Ra-228
decay, effects on separation from barium salts, 16: 23990(T) (AEC-tr-5159)
RADON
determination in air, Geiger-Mueller counter for, 16: 23833 (AEET/AH/20)
RADON ISOTOPES Rn-220
release in metallurgical processing of thorium, 16: 23373 (TID-7616 (p.3-38))
RADON ISOTOPES Rn-222
diffusion in thorium and uranium oxides, 16: 24183(T) (AEC-tr-5206)
diffusion in thorium dioxide, 16: 23674(T) (AEC-tr-5178)
RAIN WATER
fall-out monitoring in Germany, 1956 to 1960, 16: 24006
radioactivity in, Westwood, N. J., 16: 23985 (NYO-9532)
RARE EARTH ACETATES
preparation of anhydrous, by desolvation, 16: 23697
RARE EARTH CHELATES

stability constants, 16: 23684
RARE EARTH DEUTERIDES
chemical and magnetic structures, 16: 24173(R) (TID-15819)
RARE EARTH HYDRIDES
chemical and magnetic structures, 16: 24173(R) (TID-15819)
RARE EARTHS
determination of traces, activation, 16: 23649
reactions with soil, 16: 25052 (TID-7628(p.214-36))
separation from aqueous solutions by mixer-settlers, review, 16: 23793
separation from transuranic elements by anion extraction, 16: 24344
separation from transuranium elements by solvent extraction, 16: 23528(R) (ORNL-3290)
solution chemistry, 16: 23529(R) (TID-16024)
RARE GASES
determination of fission product, radiometric, 16: 24563
diffusion in graphite at high-temperatures, 16: 24184(T) (AEC-tr-5213)
occurrence in meteorite Breitscheid, 16: 23998
occurrence of primordial in meteorite chondrite Tabor, 16: 23999
RATE METERS
design of portable beta-gamma, 16: 24011 (DP-711)
RATS
antimony-124 distribution and excretion in, following inhalation, 16: 23386 (UR-608)
radiation effects on phosphorus content in microsomal lipoproteins, 16: 23450
radiation effects on cell nucleoproteins in liver, spleen, and thymus, 16: 23468
radiation effects on brain of fetal, 16: 23473
radiation effects, head exposure, 16: 23474
radiation effects on newborn head exposure, 16: 23475
radiation effects on nervous system, delayed effects, 16: 23483
radiation effects on function and growth of regenerated or transplanted adrenocortical tissue, 16: 23417(R) (TID-16122)
radiation effects on nervous system, 16: 23420 (USNRDL-TR-561)
radiation effects on metabolic reactivity, role of nervous system in, 16: 23422(T) (AEC-tr-5190)
radiation effects on cytology and structure of bone marrow, whole-body, 16: 23429 (BNL-5032)
radiosensitivity of newborn, 16: 23523
REACTOR BREEDING ELEMENTS
design of thorium-232, for improved breeding of uranium-233, 16: 24959(P)
REACTOR COMPONENTS
decontamination by single-solution chemical treatment, 16: 24496
radioinduced heating, program for calculation, 16: 24287 (UCRL-6891)
REACTOR CONTROL RODS
cooling, use of heat transfer by variable gas bond for, 16: 23821 (NAA-SR-Memo-7182)
economics for light water reactors, 16: 24485
neutron flux calculation for, computer program for two-group current-equivalent parameters for, 16: 24930 (AE-75)
testing boron carbide-nickel dispersions on stainless steel, 16: 24107 (GEAP-3831)
worth, calculation of differential, 16: 24404
REACTOR CONTROL SYSTEMS
design for boiling reactor with internal nuclear superheater, 16: 24531
design for boiling reactors, 16: 24960(P)
equipment design and operation, television in, 16: 25015 (CNEN-134)
noise measurements in servo-, 16: 24551
REACTOR COOLANTS
critical heat flux of Santowax R in forced convection, 16: 24947 (NAA-SR-Memo-6907)
development of organic, 16: 25017(R) (IDO-16761)
radiation effects on organic, development of program for studying, 16: 24941(R) (IDO-11101)
reclamation of organic, evaluation of processes and products, 16: 24940(R) (IDO-11052)
temperature, determination of optimum input, 16: 25005
temperature of feed water, calculation of reheating temperature, 16: 25006
testing of organic, 16: 25018(R) (IDO-16761(p.1-74))
REACTOR ENGINEERING
nuclear data for GAM-1 tape, 16: 24088 (GA-2451(Vol.II))
REACTOR EXPERIMENTAL FACILITIES
design of in-pile gas-cooled, for unclad fuel elements, 16: 24643
REACTOR FUEL ALLOYS
chlorination of Fissium oxide mixtures with uranium in halide systems, 16: 23663 (ANL-6546)
REACTOR FUEL ELEMENTS
analysis for uranium by radioisotope-excited x rays, 16: 23622 (TID-7629(p.81-90))
analysis of spent, radiometric, 16: 24352
burnup determination by analysis for molybdenum and neodymium, 16: 23626 (TID-7629(p.152-65))
design, FAD program for, 16: 24435
fabrication of plate-type, by vacuum brazing, 16: 24635
fission product release, mechanism study, 16: 23352(R) (BNL-705)
handling, evaluation of shielding of machine for, 16: 24948 (NAA-SR-Memo-7212)
heat transfer in annular, fuel-cladding gap effects, 16: 24502
heat transfer, local film coefficients due to boundary layer turbulence promoters, 16: 24504
pressure-drops produced by spacers for 19-rod bundle, 16: 24279 (NAA-SR-Memo-6782)
processing of irradiated, developments in solvent extraction processes for, 16: 23781 (HW-SA-2458)
processing of spent, use of mixer-settlers in, 16: 23793
production for power reactors, survey of recent developments, 16: 24113
radiation effects testing of fast reactor, in thermal reactions, 16: 24641
radiation effects on sintered-aluminum-product-clad uranium dioxide, 16: 24235 (CRFD-1084)
reactor criticality effects of irradiated, 16: 24382
rupture rates, evaluation of exposure effects in model for, 16: 24937 (HW-70400)
testing facility, design of in-pile gas-cooled, 16: 24643
testing of gas-cooled, design of facility for, 16: 24950 (ORNL-TM-250)
REACTOR FUEL ELEMENTS (CERAMIC)
coating with pyrolytic carbon, 16: 24626
core melting in clad uranium dioxide, 16: 24624
cracks in, detection of, 16: 24934 (DC-60-11-103)
development and testing highly-enriched, 16: 24625
development of SAP-clad uranium carbide and dioxide, 16: 24464
diffusion of xenon-133 and -135 from, 16: 24144 (AERE-R-4062)
fabrication by vibratory compaction, 16: 24621
fabrication of aluminum alloy-clad uranium dioxide, 16: 24463
processing by phosfluor process, 16: 24645
properties at high temperatures, survey, 16: 24606
radiation effects on SAP-clad uranium dioxide, 16: 24458
radiation effects, axial expansion of uranium dioxide in the sheath, 16: 24609
radiation effects on uranium carbide, 16: 24611
radiation effects on beryllium clad uranium dioxide, 16: 24613
radiation effects, fission product release by in-pile melting, 16: 24615
radiation effects on uranium oxide–zirconium oxide, 16: 24616
radiation effects on stainless steel-clad uranium dioxide, high temperature behavior in water during, 16: 24617
radiation effects on stainless steel-clad uranium dioxide, 16: 24618
radiation stability of 19-pin bundles, 16: 24637
thermal testing, out-of-pile, 16: 24620
REACTOR FUEL ELEMENTS (DISPERSION)
fabrication of high-density thorium–uranium carbide, 16: 24119 (GAMD-2221)
matrix failure in, 16: 24612
properties of stainless steel–uranium dioxide, 16: 24477
REACTOR FUEL PINS
meltdown studies of irradiated, 16: 24642
REACTOR FUEL RODS
depletion of irradiated uranium dioxide, evaluation of analysis techniques, 16: 24493
neutron resonance absorption in cadmium-clad uranium, 16: 24759 (AE-77)
REACTOR FUEL SPHERES
diffusion of fission products from, 16: 24627
fission product diffusion in graphite-uranium carbide, 16: 24184(T) (AEC-tr-5213)

REACTOR FUEL TUBES
criticality studies of concentric, 16: 24409
design and fabrication of concentric, 16: 24465
design of concentric, for uniform coolant conditions, 16: 24929 (AAEC/E-89)
dimensional stability, radiation effects at 1280 Mwd/t, 16: 24237 (DP-709)
REACTOR FUELS
bibliography on processing and waste disposal. I, 16: 23784 (ORNL-2971(Vol.1))
bibliography on processing and waste disposal, III, 16: 23785 (ORNL-2971(Vol.3))
burnup determination by analysis for stable fission product molybdenum, 16: 23627 (TID-7629(p.166-76))
burnup, effects of fission products on, 16: 24384
burnup studies, computer program for, 16: 24942 (KR-20)
cost factors in nuclear power plants, 16: 24993 (TID-7025(Vol.4))
cycle studies for fast power breeder reactors, 16: 24484
development for homogeneous reactors, 16: 24953(T) (AEC-tr-5165)
development of chemonuclear, 16: 23352(R) (BNL-705)
economics of plutonium and uranium-233 as, 16: 24483
fission product energy distributions from, 16: 24783 (JPL-TR-34-249)
processing of thorium, survey of methods, 16: 23789 (ORNL-TM-241)
REACTOR FUELS (FUSED SALTS)
properties of plutonium and uranium chlorides for use in fast breeder reactors, 16: 25002(T) (AEC-tr-5161)
REACTOR MATERIALS
chemical and physical properties, research progress at Lawrence Radiation Lab., 16: 24175(R) (UCRL-10119)
quantity control, program for publication of AEC measurement methods for, 16: 23635 (TID-7629(p.259-66))
radiation damage, conference summary, 16: 24251
thermodynamics, conference, 16: 23694
REACTOR MATRICES
criticality studies of tube arrays, 16: 24409
disadvantage factors for slab, convergence rates of, 16: 24402
neutron buckling and void effects in rod clusters, 16: 24414
neutron buckling in mixed-fuel, 16: 24419
neutron current at boundaries of, 16: 24403
neutron Doppler broadened resonance absorption in heterogeneous, 16: 24439
neutron leakage from heterogeneous, 16: 24938 (HW-71649)
neutron multiplication in, effects of reflectors and voids on, 16: 24415
neutron multiplication in, comparison of analytical and cadmium-ratio, 16: 24426
neutron thermal utilization in, 16: 24425
thermal neutron densities in square, two-group boundary conditions for, 16: 24772
REACTOR MODERATORS
neutron attenuation, 16: 24376
neutron diffusion in, 16: 24758 (AE-71)
neutron diffusion in, two-group boundary conditions for, 16: 24772
properties of Dowtherm A at 10 to 260°C, 16: 24774
REACTOR OSCILLATORS
design of signal detector for, 16: 24550
REACTOR SAFETY
conference summary, 16: 24027
correlations with shutdown mechanisms, 16: 24515
design and operation of electric, hydraulic, and pneumatic systems for, 16: 24957
excursion shutdown mechanism for large fast oxide reactors, 16: 24518
in nuclear power plants, 16: 25010
power excursion tests at ambient temperature, effects of system pressure, 16: 24521
shutdown mechanism using gas microbubble dilation, 16: 24522
stack disposal, atmospheric diffusion formula for use with, 16: 25079
REACTOR SAFETY EXPERIMENTS
power excursions, effect of fuel rod bowing during self-limiting, 16: 24535
pressurizer vessel failure, 16: 24490
REACTOR SHIELDING
calculations for low-power heavy water reactors, 16: 25026
design for a power reactor, 16: 24593
neutron flux distributions in iron-water, 16: 24597
REACTOR THERMAL COLUMNS
use for amplifying thermal neutron fluxes in water-moderated reactors, 16: 24955
REACTOR TUBES
fabrication by cold-bonding methods, 16: 24149(R) (BMI-X-204)
fabrication of Zircaloy-4 for CVTR, 16: 24973 (CVNA-141)
REACTORS
burnup, computer program for calculation, 16: 24944 (MND-C-2500-4)
burnup study of uniform- and nonuniform-power-distribution, 16: 24956
control of spatial xenon oscillations, 16: 24525
criticality studies, analytical approach to two-dimensional, 16: 24399
Doppler coefficients, direct measurement by self-limiting power excursion tests, 16: 24517
dynamics, high-power-describing function, 16: 24527
dynamics, Liapounoff's functions in, 16: 24526
dynamics, review of nonlinear, 16: 24523
emergency protection systems for, effects of standby components in, 16: 24954
fuel burnup studies, computer program for, 16: 24942 (KR-20)
heat transfer, application of steam energy flow to design studies, 16: 24508
helium atmosphere leakage control, 16: 24498
instrumentation, utilization of magnetic amplifiers for monitoring reliability of, 16: 23861(T) (CEA-tr-A-1126)
kinetics, calculations using computer code COLLOREK, 16: 24541
neutron diffusion in, computer programs for calculating, 16: 24436
neutron diffusion parameters for, variational calculation of fast-group, 16: 24400
neutron energy spectra and flux measurements in, methods for, 16: 23377 (TID-7616(p.69-77))
neutron flux and reactivity, computer program for static and dynamic synthesis, 16: 24943 (MND-C-2500-3)
neutron flux calculations for, refinements in two-group, 16: 24401
neutron flux instabilities in reflected slab type, xenon- and temperature-induced, 16: 24524
neutron flux synthesis approximations in the time direction, 16: 24543
neutron resonance absorption in, spatial distribution of, 16: 24392
neutron slowing down spectrum in, computer program for, 16: 24945 (MND-C-2500-5)
parameters for, measurement in critical and subcritical assemblies, 16: 24353
poisoning by fission products, errors in predicting, 16: 24385
power fluctuations, low-frequency wave analyzer for spectral density measurement of, 16: 24549
power ramp measurements, analysis using an analog computer, 16: 24529
power spectrum measurements, 16: 24538
reactivity, measurement of dynamic temperature coefficients by forced oscillations in coolant flow, 16: 24542
reactivity measurement, design of monitor for startup, 16: 24546
shutdown mechanisms, 16: 24515
shutdown mechanism using gas microbubble dilation, 16: 24522
startup, localized source multiplication in, 16: 24405
theory, British and French studies, 16: 24938 (HW-71649)
thermal analysis, CHIC codes for, 16: 24442
transient behavior, neutron flux distribution in, transfer function of spatial, 16: 25004(T) (AERE-Trans-888)
waste disposal through stacks, atmospheric diffusion formula, 16: 25079
xenon oscillations, calculation of natural modes and comparison with a simple approximation, 16: 24544
RECOIL IONS
reactions accompanying (n,γ) process, isotopic effect in, 16: 24861
REFRACTORY MATERIALS
development for solid propellant rocket motors, 16: 24178(R) (WAL-TR-766.3/1-3)
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
RELATIVITY THEORY
gravitation quantization in, formulation using no unphysical variables, 16: 24919
quantum, using statistical quantum theory for free space, 16: 24920
time determination from 3-dimensional geometry, 16: 24326

REMOTE-CONTROL EQUIPMENT
design for handling isotopes, 16: 23808 (T) (FTD-TT-62-530)
RESEARCH REACTORS
control of Ispra-1, with television camera, 16: 25015 (CNEN-134)
control rod and fuel element materials, corrosion by boiling mercury and sodium, 16: 23352(R) (BNL-705)
coolant flow rate and fuel element surface temperature in, at University of Virginia, 16: 24505
critical experiments on JRR-2, 16: 25022 (JAERI-1025)
design of swimming-pool, 16: 25028(P)
development of High Flux Beam, 16: 23352(R) (BNL-705)
fuel element failure in Westinghouse Testing Reactor, April 3, 1960, 16: 25021 (IDO-19308)
neutron energy and flux distributions in Kansas University Reactor, 16: 25025 (TID-15977)
neutron flux measurements in TRIGA, 16: 25016 (DOFL-TM-60-27)
neutron flux measurements in Polish, 16: 25027
neutron spectra in Outside Test Tank, activation data from tape measurements, 16: 24904 (DC-61-2-98)
shielding calculations for British Daphne, 16: 25026
shutdown mechanism of TRIGA, 16: 24520
RESINS
performance of Hungarian, for uranium processing, 16: 23795
RESISTORS
characteristics of thermistors, 16: 23974 (ANL- 6515(p.187-201))
RESORCINOL
preparation of tritium-labeled, 16: 23553
RHENIUM
alloying effects on chromium-cobalt-molybdenum-nickel alloys, 16: 24200
critical surface temperature relations with cesium ion current, 16: 24280 (NASA-TN-D-1307)
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
RHENIUM COMPLEXES
decomposition of bromo-, effects of bromine-80m isomeric transitions in, 16: 23764
RHENIUM ISOTOPES Re-184
decay and half life, 16: 24789(R) (NP-11874)
RHENIUM ISOTOPES Re-185
neutron reactions (n,2n) at 14.1 Mev, cross sections, 16: 24789(R) (NP-11874)
RHENIUM ISOTOPES Re-186
decay and half life, 16: 24789(R) (NP-11874)
RHENIUM ISOTOPES Re-187
neutron reactions (n,2n) at 14.1 Mev, cross sections, 16: 24789(R) (NP-11874)
RHENIUM ISOTOPES Re-188
decay and half life, 16: 24789(R) (NP-11874)
RHODIUM
solubility in bismuth at 300 to 700°C, 16: 24216
RHODIUM COMPLEXES
decomposition of bromo-, effects of bromine-80m isomeric transitions in, 16: 23764
reactions, tracer studies, 16: 23581
RHODIUM ISOTOPES Rh-102
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
RIBONUCLEIC ACID, DESOXY-
synthesis in tumor tissues, effects of chemotherapeutic agents and radiation, tracer study, 16: 23367
ROCKS
analysis for thorium and uranium by gamma emission counting, 16: 23651
RODS
sound propagation in solid, 16: 23972 (ANL-6515(p.133-61))
RUBBER
radioinduced crosslinking, effects of dimaleimides, 16: 24254
radioinduced transformation of carboxylated butadiene–styrene, 16: 23543
RUBIDIUM
movement in peppermint plant, 16: 23389
properties of liquid, as reactor coolant, 16: 23800 (BNL-5377)
separation of fission product, radiochemical, 16: 24564
RUBIDIUM CHLORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
RUBIDIUM FLUORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
RUBIDIUM IODIDE CRYSTALS
scintillation response to alphas and protons, 16: 23883
structure, pressure of polymorphic transition in, 16: 24205
RUBIDIUM IONS
diffusion in potassium chloride–rubidium chloride crystals, 16: 23692
RUBIDIUM ISOTOPES Rb-85
electron-spin-resonance spectra in rare-gas matrices at 4.2°K, 16: 23702
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
RUBIDIUM ISOTOPES Rb-86
yields from alpha and deuteron fission of uranium-233, 16: 24351
RUTHENIUM
adsorption on peat, 16: 25078
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
solubility in bismuth at 300 to 700°C, 16: 24216
RUTHENIUM ISOTOPES Ru-97
angular correlations, 16: 24794(R) (TID-15211)
RUTHENIUM ISOTOPES Ru-106
release from ORNL waste-pit system, 16: 25071 (TID-7628(p.513-31))
RUTHENIUM NITROSYLS
separation of nitro and nitrate complexes, by solvent extraction using trilaurylamine, 16: 23791 (TID-16139)

S

SAFETY
radiation hazard from surface contamination of jet aircraft, 16: 24022
requirements for industrial radiography using radioisotopes, 16: 24029
SAFETY HAZARDS
insurance problems, 16: 24025
SALT DEPOSITS
in United States, location, 16: 25067 (TID-7628(p.469-76))
radioactive waste disposal in, 16: 25040 (TID-7628(p.12-16))
radioactive waste disposal in, 16: 25067 (TID-7628(p.469-76))
radioactive waste disposal in, 16: 25068 (TID-7628(p.477-90))
underground thermonuclear explosions in, effects on earth deformation, 16: 23357 (PNE-109F)
SALTS
analysis for nitrides and oxides by high-temperature fluorination, 16: 23638 (TID-7629(p.295-307))
SAMARIUM
burnup in reactors, 16: 24486
solubility in bismuth at 300 to 700°C, 16: 24216
SAMARIUM FLUORIDES
solubility in molten fluoride mixtures, 16: 23595
SAMARIUM HYDRIDES
magnetic moments, 16: 24173(R) (TID-15819)
SAMARIUM ISOTOPES Sm-145
gamma emission, 16: 24583
SAMARIUM ISOTOPES Sm-153
gamma emission, 16: 24583
SANDS
drift measurement on Japanese coasts, tracer study, 16: 24003
drift measurement on Portugal seacoasts, tracer study, 16: 24005
SATELLITES
nuclear power plants, effects of space radiation on, 16: 24547
SAVANNAH RIVER PLANT
geology and hydrology of area, 16: 25044 (TID-7628(p.115-29))
geology of site, 16: 25061 (TID-7628(p.380-95))
waste disposal in ground, 16: 25044 (TID-7628(p.115-29))
SCALERS
design of pulse, 16: 23845 (NP-11734)
development of multipurpose readout type, 16: 23842 (CREL-952)
SCANDIUM
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))

determination, photometric, 16: 23657
determination, tracer techniques for, 16: 23736
geochemistry and mineralogy, 16: 24000
SCANDIUM ISOTOPES Sc-41
positron emission, decay scheme and spectra, 16: 24836
SCANDIUM ISOTOPES Sc-43
yields in proton spallation of copper at 24 Bev, 16: 24859
SCANDIUM ISOTOPES Sc-44
yields in proton spallation of copper at 24 Bev, 16: 24859
yields of metastable, in proton spallation of copper at 24 Bev, 16: 24859
SCANDIUM ISOTOPES Sc-46
tracer use for determination of scandium, 16: 23736
tracer use in measurement of sedimentation drift, 16: 24001
tracer use in sedimentation measurements in Bombay Harbor, 16: 24002
yields in proton spallation of copper at 24 Bev, 16: 24859
SCANDIUM ISOTOPES Sc-47
yields in proton spallation of copper at 24 Bev, 16: 24859
SCANDIUM ISOTOPES Sc-48
yields in proton spallation of copper at 24 Bev, 16: 24859
SCATTERING
amplitude analytic continuation in angular momentum, 16: 24743 (UCRL-10116)
amplitude singularities at isolated real points, 16: 24732
equation, formulation of nonlinear singular integral Low, 16: 24913 (JINR-P-890)
equation, operators connected with nonlinear singular integral Low, 16: 24914 (JINR-P-901)
phase shifts for two-nucleon, 16: 24708
potential, with complex angular momentum and energy, 16: 24310
radius in, calculation of lower limit for, 16: 24740
S-states in potential, 3-body Green's function for, 16: 24733
spectral functions, from extrapolation of amplitudes, 16: 24312
theory, poles in low energy, 16: 24912 (AD-270903)
SCINTILLATION DETECTORS
characteristics, statistical evaluation of, 16: 23848 (SCTM-326-61(14))
circuit for canceling background radiation in Hornyak buttons, 16: 23916 (UAC-6092)
circuit systems for whole-body liquid, design and performance of, 16: 23875
conference, 16: 23876
description of 4π liquid, for fast neutron bursts, 16: 23921
design and performance of spectrometer for solar gamma radiation, 16: 23926
design and use of 4π liquid, 16: 23871
design for positrons in space, 16: 23924
design for triggering photography of mesons(K^+) in hydrogen bubble chamber, 16: 23919
design for use in space, 16: 23927
design of balloon-borne cosmic-ray telescope, 16: 23925
design of gamma spectrometer for studying lunar composition, 16: 23930
design of large-area, 16: 23937
design of liquid, 16: 23920
efficiency, effects of temperature, 16: 23858(T) (AEC-tr-5120)
particle discrimination by thallium activated potassium iodide, effects of crystal temperature and thallium content, 16: 23956
performance, separation of gamma pulses from neutron pulses, 16: 24579
properties and uses of liquid, 16: 24337
pulse shape discrimination, survey, 16: 23913
resolution, 16: 23881
resolution, 16: 23915 (UCRL-9976)
resolution, effects of dislocations, 16: 23882
review, 16: 23874
review, 16: 23942
sensitivity improvement by efficient light collection, 16: 24578
use as spectrometers in space, 16: 23928
SEA WATER
analysis for oxygen, radiometric, 16: 24577
SEDIMENTATION
drift measurement using radioisotopes, 16: 24001
drift measurement at Europoort using radioisotopes, 16: 24004
SEED
genetic effects of irradiation in Triticinae, 16: 23454
radiosensitivity, factors affecting, 16: 23469
radiosensitivity, factors affecting, 16: 23369
SELENIUM
neutron total cross sections at 0.003 to 0.008 ev, 16: 24811
SELENIUM COMPOUNDS
synthesis of radioprotective analogs of 2-aminoethylthiouronium salts, 16: 23515(R) (AD-269983)
SELENIUM ISOTOPES Se-80
neutron reactions (n,γ), activation measurements for, 16: 24787 (NP-11793)
SEMICARBAZIDE
reactions with aldehydes, carbon-14 and tritium isotope effects, 16: 23577
SEMICONDUCTOR DETECTORS
design and performance of solid-state fission counters, 16: 24553
fabrication and performance, 16: 23838 (BNL-737)
fabrication and performance of thin diffused-junction $\Delta E/\Delta x$, 16: 23898
fabrication and performance of lithium-drifted p^+-i-n^+ diode, 16: 23900
fabrication and properties of n^+-i-p^+, 16: 23896
fabrication and properties of boron-10-diffused silicon junction, 16: 23903 (UAC-6130)
neutron detection and measurement with silicon-junction, 16: 24846
performance as alpha spectrometer, 16: 23840 (CEA-2138)
properties and uses outline, 16: 23870
properties for use in detecting fast neutrons, 16: 23899 (AERE-R-3874)
pulse shape discrimination circuit for, 16: 23901 (PUC-1962-69)
response of silicon surface barrier, to hydrogen ions, 16: 23904 (SCDC-2522)
review, 16: 23894
review, 16: 23944
use of gold-doped silicon, to control bubble chamber photography, 16: 23905 (PPAD-437E)
use, review, 16: 23895
use to detect alpha particles in chemical process streams, 16: 23902
window thickness of diffusion junctions, reduction, 16: 23897
SEMICONDUCTORS
galvanomagnetic properties, in presence of anisotropic electron scattering, 16: 24331
magnetic coefficients for, tables, 16: 23835 (AFOSR-2665)
superconductivity in polar and nonpolar, 16: 24332
SEPARATION PROCESSES
development of phosfluor process for ceramic fuels, 16: 24645
SHELTERS
blast effects from atomic explosions on communal, instruments for measuring, 16: 23856 (WT-790)
blast effects on animals and dummies in group, 16: 24017 (WT-798)
effects of atomic explosions on AEC prototype communal, 16: 23359 (WT-360)
evaluation of family and personnel type, for protection during atomic explosion, 16: 24018 (WT-1161)
testing French underground, in Plumbbob operation, 16: 24019 (WT-1453)
SHERWOOD PROJECT
cryogenic aspects, research summary, 16: 24888(R) (NBS-7244)
SHIELDING
book: *Concrete for Radiation Shielding*, 16: 24220(NP-11837)
design for radiation belt particles, 16: 24910
effects on adsorption dose factor of cylindrical source, 16: 24909
gamma attenuation in slab, computer program for calculation, 16: 24907 (WAPD-T-1464)
gamma-ray transmission through slabs, 16: 24601
properties of concrete, 16: 24221
radioinduced heating, neutron, 16: 23959
requirements for Plutonium Reclamation Facility, 16: 23780 (HW-68021)
SHIELDING MATERIALS
properties, protective and thermal, 16: 25031 (JPL-TR-32-232)
SHIPPINGPORT PRESSURIZED WATER REACTOR
control rod withdrawal transients in, analog simulation and testing, 16: 25000 (WAPD-PWR-TE-99)
coolant flow and pressure drop in Core-1, Seed 2, 16: 24999 (WAPD-PWR-TE-98)
cooling system pressure drop tests, 16: 24979 (DLCS-1470107(Rev.))

development, 16: 24998(R) (WAPD-MRP-97)
emergency plan, 16: 24010 (DLCS-5020100)
fuel element fabrication, 16: 24626
fuel rod isotopic composition after irradiation, 16: 24493
operation, February 1962, 16: 24995(R) (TID-15224)
operation, May 1962, 16: 24980(R) (DLCS-5000562)
operational experience through three seeds, 16: 24492
shielding construction inside containment vessels, 16: 24232
steam generator blowdown sludge removal rate, evaluation, 16: 25001 (WAPD-PWR-TE-118)
SHOCK TUBES
condensation processes behind shocks in, feasibility of optical studies, 16: 24889 (NP-11601)
design and performance of large, 16: 24275 (CLM-R-18)
SHOCK WAVES
from exploding wires at low ambient densities, 16: 24273 (BRL-1152)
hydrodynamic characteristics, analysis, 16: 24286 (UCRL-6797)
photographic examination, design of high-speed camera for, 16: 23952 (UTIA-TN-26)
SIGMA PILES
standardization of Kansas State, 16: 24761 (TID-15667)
SILANES
radiation effects on polymerization of allyl-, 16: 23747
SILICON
alloying effects on aluminum–niobium oxidation by air, 16: 24174 (TID-16032)
determination in aluminum alloys by fast neutron activation, 16: 24574
determination in cast iron by fast neutron activation, 16: 24573
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
Fermi-levels in, 16: 24158 (K-1526)
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
neutron cross section, corrections, 16: 24796 (UNC-5002)
proton reactions (p,p), phosphorus-29 levels from, 16: 24795 (TID-15331)
radiation effects on electrical and optical properties, 16: 24234 (ARL-62-343)
SILICON COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
SILICON ISOTOPES Si-28
neutron reactions (n,α) at 14.6 Mev, alpha spectra from, 16: 24846
proton reactions (p,p′), phosphorus-29 levels from, 16: 24795 (TID-15331)
SILICON ISOTOPES Si-29
alpha reactions (α,n) at 3.7 to 5 Mev, cross section fluctuations, 16: 24845
SILICON JUNCTIONS
performance as alpha spectrometer, 16: 23840 (CEA-2138)
SILICON OXIDE–SODIUM OXIDE SYSTEMS
diffusion of calcium, potassium, and sodium ions in, in melts with calcium, lithium, and potassium oxides, 16: 24038(T) (AEC-tr-5191)
SILICON OXIDE–ZIRCONIUM OXIDE SYSTEMS
ceramic properties, 16: 24210
SILICON OXIDES
fabrication for radome use, 16: 24132(R) (NP-11713)
SILICON OXIDES (FUSED)
ultrasonic propagation in deformed, 16: 23971 (ANL- 6515(p.121-32))
SILICON–THORIUM–URANIUM SYSTEMS
corrosion and oxidation, 16: 24630
SILICON–TITANIUM SYSTEMS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
SILICON–URANIUM SYSTEMS
sintering by hot pressing, reaction, 16: 24136
SILICON–VANADIUM SYSTEMS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
SILICONE RUBBERS
radioinduced chlorination, 16: 23759
SILTS
drift measurement on Portugal seacoasts, tracer study, 16: 24005
sedimentation measurement in Bombay Harbor, tracer study, 16: 24002
SILVER
compatibility with lead telluride, 16: 24161 (NAA-SR-Memo-7172)
determination in biological materials, activation, 16: 23403
SILVER BROMIDE CRYSTALS
structure, latent image study of, 16: 23967 (ANL-6515(p.81-6))
SILVER CHLORIDE CRYSTALS
use to detect cosmic particles and nuclear processes, 16: 23931
SILVER HALIDES
solubility in aqueous solutions, 16: 23706
SILVER ISOTOPES Ag-110
tracer use for measurement of sand and silt drift on Portugal seacoasts, 16: 24005
SILVER ISOTOPES Ag-111
production of carrier-free, electrolytic, 16: 24083
SILVER ISOTOPES Ag-112
yields from alpha and deuteron fission of uranium-233, 16: 24351
SINTERING
process kinetics and theoretical analysis of techniques, 16: 24116
SIOUX FALLS POWER REACTOR
design and development, 16: 24962(R) (ACNP-62005)
safeguards analyses, Part II, 16: 24961 (ACNP-5905)
SKELETON
effects of radiation sickness on joints, 16: 23524
SKIN
effects of radiation sickness on blood vessels and temperature, 16: 23518
radiation effects on, 16: 23444
radiation effects on photoceptors in frogs, 16: 23444
radiosensitivity, effects of oxygen tension, 16: 23466
SLEEP REACTOR
fuel rod neutron resonance absorption, 16: 24759 (AE-77)
SMOKES
diffusion at ambient temperature from chimney, 16: 23991(T) (AWRE-Trans-34)
SODIUM
compatibility with molybdenum alloys used as fuel cladding material, 16: 24145 (ANL-6268)
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
diffusion of liquid, neutron scattering studies of, 16: 24271 (AERE-R-4043)
neutron cross sections, corrections, 16: 24796 (UNC-5002)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
neutron scattering resonance cross sections for, fast, 16: 24387
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
reactor criticality effects, 16: 24407
self-diffusion in melts containing silica and sodium oxide, lithium oxide, calcium oxide, and potassium oxide, 16: 24038(T) (AEC-tr-5191)
SODIUM (LIQUID)
flow control for heat transfer regulation in reactors, 16: 24952 (TID-15913)
SODIUM BROMIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
SODIUM CARBONATES
carbon exchange with potassium cyanide, 16: 23558
SODIUM CHLORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
SODIUM CHLORIDES
elastic properties of deposits in Project Cowboy tests, 16: 23804 (RM-3105-AEC)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
SODIUM DODECYL SULFATES
sorptive properties at surface layer for recoil bismuth ions, 16: 23585
SODIUM FLUORIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
SODIUM FLUORIDE–URANIUM(IV) FLUORIDE–ZIRCONIUM FLUORIDE SYSTEMS
solvent properties for rare earth fluorides, 16: 23595

SODIUM FORMATES
precipitation of fluorides and zirconium from fuel dissolver solutions with, 16: 23782 (IDO-14582)
SODIUM HYDROXIDES
electrolytic effects on sedimentation rate of uranium (IV–VI) oxide suspensions, 16: 23699
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
radiolysis of aqueous solution with sodium sulfite, hydrogen yield in, 16: 23716 (PAN-290/ChR)
SODIUM IODIDE CRYSTALS
nuclear quadrupole coupling constants in, 16: 24654
response of thallium-activated, to x rays and low-energy gamma rays, 16: 23879
response to heavy particles of thallium-activated, effects of delta rays, 16: 23880
scintillation resolution of thallium-activated, effects of dislocations, 16: 23882
scintillation response to alphas and protons, 16: 23883
SODIUM ISOTOPES Na-22
yields in proton spallation of copper at 24 Bev, 16: 24859
SODIUM ISOTOPES Na-23
electron-spin-resonance spectra in rare-gas matrices at 4.2°K, 16: 23702
nuclear quadrupole coupling constants in alkali halide crystals, 16: 24654
SODIUM ISOTOPES Na-24
yields in proton spallation of copper at 24 Bev, 16: 24859
SODIUM NIOBATE–STRONTIUM NIOBATE SYSTEMS
phase studies and electric properties, 16: 23687
SODIUM NITRATES
separation from nitric acid by solvent extraction using trilaurylamine, 16: 23791 (TID-16139)
SODIUM PYROPHOSPHATES
electrolytic effects on sedimentation rate of uranium (VI–VI) oxide suspensions, 16: 23699
SODIUM REACTOR EXPERIMENT
fuel handling, dose rates from shielding of machine for, 16: 24948 (NAA-SR-Memo-7212)
fuel rod bowing, 16: 24536
SODIUM SULFITES
radiolysis of aqueous solution with sodium hydroxide, hydrogen yield in, 16: 23716 (PAN-290/ChR)
sulfur exchange with sulfur dioxide, 16: 23574
SODIUM THIOSULFATES
decomposition and oxidation, 16: 23574
SOILS
analysis for uranium alpha activity by precipitation, 16: 23596 (AERE-R-3499)
contamination, detection by tree analysis, 16: 23406 (CEA-2131)
density and moisture measurement, bibliography on nuclear methods for, 16: 23982 (AERE-Bib-140)
geochemical properties, effects on retention of radionuclides, 16: 25052 (TID-7628(p.214-36))
geohydrologic features affecting waste disposal, measurement, 16: 25042 (TID-7628(p.77-98))
ground water flow in heterogeneous and homogeneous, mathematical analysis, 16: 25045 (TID-7628(p.130-44))
hydrologic factors affecting retention of radioactive wastes, 16: 25041 (TID-7628(p.67-76))
percolation of fission products in, effects of physiochemical characteristics, 16: 25050 (TID-7628(p.198-210))
percolation of plutonium in waste solutions, 16: 25054 (TID-7628(p.248-81))
permeability by moisture, effects of treatment with bentonites, 16: 25066 (TID-7628(p.462-8))
reactions with rare earths, 16: 25052 (TID-7628(p.214-36))
sorptive properties for radioisotopes, 16: 25048 (TID-7628(p.179-86))
sulfate exchange and sorption by less-retentive, 16: 23539
thermal radiation reflectivity, 16: 23854 (WT-543)
SOLAR BATTERIES
properties evaluation for use outside earth's atmosphere, 16: 25029 (AD-269180)
SOLAR FLARES
magnetic cloud ejection during, effects on cosmic and geomagnetic storms, 16: 24667
measurements during Nov. 1960, 16: 24306
SOLAR RADIATION
corpuscle stream reaction with geomagnetic field, 16: 24657 (R62SD30)
emission and propagation of energetic, that excites polar-cap blackouts, 16: 24305
measurements during Nov. 1960, 16: 24306
SOLIDS
diffusion coefficients at various temperatures by continuous process by method of radioactive surfaces, 16: 23704
excited Bose-Einstein excitation in, 16: 24320
galvanomagnetic effects in, electron interaction relation to, 16: 24319
pressure effects, bibliography and data on high-, 16: 24115
radiation damage by high-energy particles, statistical theory, 16: 24256
radiation damage, conference summary, 16: 24251
sound wave detection and generation in, ultra-high-frequency, 16: 23970 (ANL-6515(p.117-20))
vacancy introduction into crystalline, at high concentrations, 16: 24309
SOLUBILITY
determination of small, radiochemical, 16: 23706
SOLVENT EXTRACTION PROCESSES
development of quantitative TBP-petrol, 16: 23653
development review, 16: 23781 (HW-SA-2458)
SORPTION
of strontium on minerals, tracer study, 16: 25049 (TID-7628(p.187-97))
SOUND
detection and generation of ultra-high-frequency waves in solids, 16: 23970 (ANL-6515(p.117-20))
propagation in solid rods, 16: 23972 (ANL-6515(p.133-61))
SPACE FLIGHT
radiation problems in, biological and medical aspects, 16: 23432
shielding requirements for minimum exposure in, 16: 24013 (NASA-TN-D-1267)
SPACE VEHICLES
nuclear power plants, effects of space radiation on, 16: 24547
propulsion systems, radiations in, 16: 23432
shielding design, 16: 24910
temperature-control engineering of nuclear-electric ion-propelled, 16: 25031 (JPL-TR-32-232)
SPARK DETECTORS
delay time between particle passage and spark, reduction, 16: 23910 (BNL-6101)
design of electronic, with data recording on magnetic tape, 16: 23909
ionization effects from hyperon(Λ^0) decay, 16: 23908
performance of methane-filled, 16: 23867
review, 16: 23907
SPECTROMETERS
design and operation of ultrasonic cw, for electron spin-phonon interactions in solids, 16: 23950
development for determination of uranium-235, 16: 23616 (TID-7629 (p.22-30))
development of automated for analyses of beryllium on filter paper discs, 16: 23614 (TID-7629(p.1-15))
use of goniometer with high-temperature x-ray diffractometers, 16: 23837 (ARL-62-315)
SPECTROPHOTOMETERS
development high-resolution, single-beam flame type using commercial components, 16: 23617 (TID-7629(p.31-41))
SPECTROSCOPY
instrument operation and service manual for scintillation and semiconductor, 16: 23846 (ORNL-TM-137)
SPHERES
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
SPINAL CORD
radiation effects of repeated low dose and single high dose, 16: 23482
radiation effects on neurons, 16: 23502
SPLEEN
radiation effects on nucleoproteins in, 16: 23468
SQUID
radioinduced browning, effects of sugar, 16: 24071

STACK DISPOSAL
atmospheric diffusion formula for, 16: 25079
STAINLESS STEEL
bending to zircaloy, 16: 24149(R) (BMI-X-204)
corrosion and metallurgical changes by steam at 1200 to 1500°F, 16: 24126
corrosion by air and steam at 1100 to 1500°F, scale formation, 16: 24125
corrosion by decontaminating solution, 16: 24496
corrosion by hydrofluoric-nitric acid mixtures, effects of aluminum nitrate on, 16: 24120 (HW-73211)
corrosion by steam at 1100 to 1500°F, effects on heat-transfer properties of tubes, 16: 24127
decontamination, effects of temperature, 16: 23779 (DC-61-6-5)
deuteron bombardment at 2 Mev, distribution from, 16: 23964 (ANL-23964 (ANL-6515(p.9-27))
dissolution in nitrate solutions, electrolytic, 16: 23783 (IDO-14584)
radiation effects on torsional stresses in, 16: 24236 (DP-669)
radiation effects on mechanical properties, 16: 24239 (HW-SA-2547)
radiography of thin section, techniques for low-voltage, 16: 23980
STAINLESS STEEL–URANIUM(IV) OXIDE COMPACTS
properties as reactor fuel, 16: 24477
STARCHES
radiation effects, 16: 23750
STARS
neutrino emission in, theory, 16: 24659
STATISTICS
distribution of stochastic fields, 16: 24882 (ARL-250)
neutron fluctuations in multiplying media, 16: 24775
programming and variational principles of classical and statistical mechanics, dynamic, 16: 24295
quantum theory for free space using, 16: 24920
radiation damage theory, for high-energy particles on crystalline solids, 16: 24256
STEAM
corrosive effects on stainless steel tubes at 1100 to 1500°F and 2 kpsi, 16: 24125
corrosive effects on tubing alloys at 1200 to 1500°F, 16: 24126
corrosive effects on stainless steel tubes, effects on heat-transfer properties, 16: 24127
properties as reactor coolant, 16: 23830 (BNL-5377)
separation requirements for large superheater reactors, 16: 24969 (CEND-116)
use in operating submarine engines, design study, 16: 23798 (AD-269390)
STEAM–WATER SYSTEMS
burnout and pressure drops in flow in round tubes, 16: 23816 (EURAEC-42)
velocity of rising steams in, 16: 24510
STEEL
analysis for arsenic in lead-free, spectrographic, 16: 23597 (AERE-R-3974)
analysis for uranium, methods for, 16: 23604 (NP-11873)
decarburization effects on properties of ultrahigh-strength, 16: 24152 (DMIC-Memo-154)
diffusion of chromium in, effects of carbon content, 16: 24199
gamma and x-ray absorption by, 16: 24223
gamma-ray attenuation in vertical slab, geometry and barrier attenuation, 16: 24603
preparation and properties of non-aging low-carbon electrochemical, 16: 24198
properties for use in reactor pressure vessels, survey, 16: 24215
radiation damage by neutrons, spectral dependence, 16: 24638
structure of nitrided zones in, 16: 24182(T) (AEC-tr-5203)
ultrasonic propagation in deformed type C1018, 16: 23971 (ANL-6515(p.121-32))
STILBENE
spectra, harmonic vibrational wave numbers in, 16: 23705
STILBENE (LABELED)
spectra, harmonic vibrational wave numbers in, 16: 23705
STRANGE PARTICLES
interactions at high energies, hyperon and nucleon magnetic moments from, 16: 24739
STRATOSPHERE
distribution of strontium isotopes in, Australian and U. S. data, 16: 24012(R) (HASL-127)
STRONTIUM
content in clams in Clinch and Tennessee Rivers, 16: 23410 (ORNL-TM-270)
content in human bones and diet, 16: 23370 (AERE-R-4035)
determination in milk by gel filtration, 16: 23654
determination in strontium-90 recovery samples, methods for, 16: 23601 (HW-69677)
intestinal absorption, effects of alkaline earths and pH, tracer study, 16: 23398 (HW-SA-2519)
reactions with sorbent minerals, tracer study, 16: 25049 (TID-7628 (p.187-97))
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
sorption on Victorian brown coal, 16: 25033 (AAEC/TM138)
STRONTIUM HAFNATES
effects on phase transitions of lead hafnate, 16: 23688
STRONTIUM IONS
exchange between solution and ionic crystals, 16: 23575
STRONTIUM ISOTOPES
percolation in soil, effects of physicochemical characteristics of soil, 16: 25050 (TID-7628(p.198-210))
STRONTIUM ISOTOPES Sr-82
decay scheme, 16: 24812
STRONTIUM ISOTOPES Sr-89
distribution in fallout deposition at world-wide HASL cooperating stations, 16: 24012(R) (HASL-127)
production of carrier-free, by solid solutions, 16: 24084
STRONTIUM ISOTOPES Sr-90
content in clams in Clinch and Tennessee Rivers, 16: 23410 (ORNL-TM-270)
content in drinking water in United Kingdom, 1961, 16: 24033
deposition in bones, effects of kinetics of administration, 16: 23441
determination in bones, 16: 23402
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
distribution in fallout deposition at world-wide HASL cooperating stations, 16: 24012(R) (HASL-127)
gamma emission, 16: 24583
human assimilation and in-body deposition, 16: 24012(R) (HASL-127)
production of carrier-free, by solid solutions, 16: 24084
removal from solutions by calcite-phosphate column, 16: 25051 (TID-7628(p.211-13))
sorption and retention by soils, 16: 25052 (TID-7628(p.214-36))
tumor induction in mice by injections, 16: 23464 (UAC-4763)
STRONTIUM SULFATES
solubility in water, effects of particle size, 16: 23592
strontium ion exchange with solution, 16: 23575
STRONTIUM THIOCYANATES
solubility in water, 16: 23706
STRONTIUM TITANATES
dielectric constants at 70 to 5000 cm^{-1} in, 16: 24321
STRUCTURES
blast effects on German underground, 16: 24020 (WT-1454)
STYRENE POLYMERS
preparation of tritium-labeled, by electric discharge, 16: 23551
radiation effects on luminescence, 16: 23761
radioinduced crosslinking, localized neutron, 16: 23720(T) (AEC-tr-5144)
radioinduced graft polymerization of acrylonitrile on, 16: 23541
radiolysis, 16: 23745
radiolysis, mechanism of resistance to, 16: 23546
radiolysis of p-substituted, 16: 23742
STYRENES
polymerization initiated by azobisisobutyronitrile and radiation, 16: 23738
radioinduced graft polymerization with polyethylene, 16: 23718(T) (AEC-tr-4321)
radioinduced graft polymerization on cotton cellulose, 16: 23544

radioinduced polymerization with acrylonitrile, 16: 23739
radioinduced polymerization of styrene and 2,4-dimethylstyrene at low temperatures, 16: 23740
radioinduced polymerization of styrene and 2,4-dimethylstyrene at low temperatures, effects of phase change, 16: 23741
radioinduced polymerization with acrylonitrile, 16: 23758
radioinduced polymerization with isobutene, 16: 23760
radioinduced polymerization, mechanism, 16: 23545
SUBMARINE REACTORS
control and machinery systems maintenance considerations, 16: 24963 (AD-269402)
SUBMARINE REACTORS (S5G)
coolant flow pressure drop in, 16: 23819 (KAPL-M-WAG-1)
SUBMARINES
propeller drive, design of fluid transmissions for, 16: 23800(R) (AD-269399)
propulsion by steamotor, design study, 16: 23798 (AD-269390)
transmission systems evaluation for steam-powered, 16: 23799 (AD-269398)
SUCCINATES
tritium exchange with water, 16: 23390
SUCCINIC ACID
complexing with uranyl ion, bonding and stability constants, 16: 23387 (UR-611)
SUGARS
radiation effects on 270 mμ absorption coefficient of solutions, 16: 24071
SULFATES
exchange and sorption by less-retentive soils, 16: 23539
metabolism and distribution of radioactive, in chick stomach, 16: 23401
SULFEX PROCESS
effects of burnup on, 16: 24644
SULFIDES
preparation of sulfur-35-labeled organic, 16: 23550
SULFUR
determination in human hair, radiochemical, 16: 23379 (TID-7616 (p.89-97))
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
exchange between sulfur gas and sulfur oxides, 16: 23574
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
gamma reactions (γ,nt) at 30 to 80 Mev, 16: 24842
movement in peppermint plant, 16: 23389
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
radiosensitivity effects on polyphenyls, 16: 25018(R) (IDO-16761(p.1-74))
reactions with butadiene and isoprene polymers, 16: 23538
SULFUR DIOXIDES
boiling and melting points and vapor pressures, effects of O-18 labeling, 16: 23693
oxidation to trioxide on platinum catalyst, kinetics, 16: 23584
sulfur exchange with sulfur gas, sulfites, and sulfates, 16: 23574
SULFUR ISOTOPES S-32
gamma reactions (γ,np) at 30 to 80 Mev, 16: 24842
neutron reactions at 2 to 5 Mev, cross section fluctuations, 16: 24845
SULFUR ISOTOPES S-35
determination using liquid scintillation counters, 16: 24337
effects on survival of rats and mice receiving subsequent lethal doses of x radiation, 16: 23443
production by bombardment of ferric chloride, 16: 24082
reactions of recoil atoms with cyclic hydrocarbons, 16: 23550
use, 16: 24076
yields from chlorine-35 (n,p) reactions in chlorobenzene, 16: 23719(T) (AEC-tr-5093)
yields in proton spallation of copper at 24 Bev, 16: 24859
SULFUR ISOTOPES S-38
yields in proton spallation of copper at 24 Bev, 16: 24859
SULFURIC ACID
properties as eluant for inorganic ion chromatography on zirconium phosphate paper, 16: 23650
SUN
nucleosynthesis in early history, 16: 24658
SUPERCONDUCTIVITY
detection in polar and nonpolar semiconductors, 16: 24332
in very thin films, measurement, 16: 24142 (AD-270673)
SUPERHEATERS
corrosion of tubes by air and steam in, at 1100 to 1500°F, 16: 24125
corrosion of tubes by steam in, at 1200 to 1500°F, 16: 24126
corrosion of tubes by steam in, effects on heat-transfer properties, 16: 24127
SUPERHEATERS (NUCLEAR)
control of boiling reactor containing internal, 16: 24531
criticality studies, 16: 24409
design of mixed-spectrum, 16: 24473
design of mixed-spectrum, physics analysis of, 16: 24474
design of mixed-spectrum, 16: 24473
fuel element fabrication, 16: 24635
materials, literature survey, 16: 24155 (GEAP-3875)
neutron thermal utilization in, 16: 24425
steam separation requirements for large, 16: 24969 (CEND-116)
steam separator, mathematical analysis of Vane-type, 16: 24936 (GEAP-4012)
SURFACE PROPERTIES
measurement by charged-particle reactions, 16: 24568
measurement by charged particle reactions, 16: 24569
SURFACE REACTIONS
of charge particles, use to determine composition of surfaces, 16: 24568
of charge particles, use to determine composition of surfaces, 16: 24569
SURFACE WATERS
analysis for uranium alpha activity by precipitation, 16: 23596 (AERE-R-3499)
SUSPENSIONS
separation from uranium wastes solutions, methods for, 16: 23385 (TID-7616(p.223-34))
SWIMMING POOL REACTORS
design, 16: 25028(P)
neutron flux distribution in Susie at low power, 16: 24933 (DC-60-6-722)
SYNCHROCYCLOTRONS
electron acceleration in annular, 16: 24866 (JINR-P-914)
proton beam properties in Russian 10-Bev, 16: 24871(T) (UCRL-Trans-843)
SYNCHROTRONS
control system, geodetic problems, magnet power supply, and vacuum systems of CERN proton, 16: 24865 (CERN-62-3)
design of 7-Bev proton, 16: 24872
magnet testing for 10 Bev, 16: 24877
SYSTEMS FOR NUCLEAR AUXILIARY POWER
coolant, development of materials for containment of alkali metal, 16: 24165(R) (NP-11824)
shielding, 16: 24594
shielding, calculations using Monte Carlo method, 16: 24595

T

TANTALUM
analysis for tungsten by thiocyanate spectrophotometric method, 16: 23619 (TID-7629(p.55-61))
coating with ceramics and metals, 16: 24148(R) (ASD-TR-61-676)
corrosion by chloride solutions, 16: 23528(R) (ORNL-3290)
critical surface temperature relations with cesium ion current, 16: 24280 (NASA-TN-D-1307)
deformation and recovery, point defects in, 16: 24258
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
gamma reactions (γ,d) and (γ,p) at 30 to 90 Mev, 16: 24835
mechanical and physical properties at 4000 to 6000°F, 16: 24162 (NP-11654)
radiation effects, neutron, 16: 24639
specifications for sheet rolled, 16: 24160 (MAB-184-M)
TANTALUM ALLOYS
corrosion by acids at high temperature, 16: 24129
specifications for sheet rolled, 16: 24160 (MAB-184-M)

TANTALUM CHLORIDES
reactions with potassium chloride, tracer study of gaseous, 16: 23709 (JINR-P-957)
TANTALUM ISOTOPES Ta-181
energy levels and decay schemes, 16: 24807
neutron photoproduction cross sections, 16: 24778 (CEA-2148)
TANTALUM ISOTOPES Ta-182
tracer use in measurement of sedimentation drift, 16: 24001
TANTALUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24268
TANTALUM--TUNGSTEN ALLOYS
coating with aluminum-tin alloys, 16: 24163(R) (NP-11711)
coating with ceramics and metals, 16: 24148(R) (ASD-TR-61-676)
TANTALUM--VANADIUM ALLOYS
coating with ceramics and metals, 16: 24148(R) (ASD-TR-61-676)
TAURINE
preparation of sulfur-35-labeled, 16: 23561
TEAPOT OPERATION
blast effects on family and personnel type shelters, evaluation, 16: 24018 (WT-1161)
TELEVISION EQUIPMENT
design and operation for reactor control, 16: 25015 (CNEN-134)
TELLURIUM
determination in bismuth, chromatographic, 16: 23602 (IA-639)
neutron total cross sections at 0.003 to 0.008 ev, 16: 24811
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
TELLURIUM ISOTOPES Te-121
production in antimony-121 (d,2n) reactions at 9 to 28 Mev, effective cross sections for, 16: 24786 (NP-11791)
TEMPERATURE CONTROL
engineering nuclear-electric ion-propelled space vehicle, 16: 25031 (JPL-TR-32-232)
TENNESSEE RIVER SYSTEM
calcium, strontium, and strontium-90 content in clams in, 16: 23410 (ORNL-TM-270)
TERBIUM
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
TERBIUM ISOTOPES Tb-157
radioactivity, 16: 24814
TERBIUM ISOTOPES Tb-158
radioactivity, 16: 24814
TEREPHTHALIC ACID, ETHYLENE POLYMER ESTERS
radiation effects of electrons, 16: 23746
TERPHENYL
properties as reactor coolant, 16: 23830 (BNL-S377)
TERPHENYLS
boiling, effects of nitrogen on subcooled nucleate, 16: 23820 (NAA-SR-6891)
critical heat flux of Santowax R in forced convection, 16: 24947 (NAA-SR-Memo-6907)
heat transfer properties of irradiated, 16: 24456
radiation effects, 16: 24455
radiation effects, studies in in-pile loop, 16: 24941(R) (IDO-11101)
radiolysis, neutron, 16: 24457
separation from biphenyl, methods for, 16: 23603 (JEN-91-DQ/I-25)
TETRAZOLIUM COMPOUNDS
synthesis of carbon-14-labeled, 16: 23555
TEXTILES
radiation effects on polymeric fibers, 16: 24249
radiation effects on mechanical properties of polymeric fibers, 16: 24250
radiation effects on thermal stability of polyolefin fibers, 16: 24255
THALLIUM CRYSTALS
thermal expansion at 4.2 to 273°K, anisotropic, 16: 24193
THERMAL CONDUCTIVITY
measurements, development of methods and apparatus for, 16: 24209
THERMAL CONDUCTIVITY CELLS
design for measuring by absolute method, 16: 24176 (WADD-TR-60-749(Pt.II))
THERMAL NEUTRONS
effects on germanium monocrystals, 16: 24245(T) (AEC-tr-5147)
filter design for removing, from reactor spectrum, 16: 24641
flux amplification in water-moderated reactors, thermal columns for, 16: 24955
flux measurements with gold foils, corrections for, 16: 24361
flux measurements by metal foil activation, 16: 24363
flux measurements at 5 ev using thick gold detectors, 16: 23841 (CEA-2162)
flux perturbation by probes, 16: 24360
fluxes in paraffin, 16: 23964 (ANL-6515(p.9-27))
scattering by heavy water, model for incoherent, 16: 24379
scattering by liquids, incoherent approximation for cross sections, 16: 24768(T) (AEC-tr-5158)
spectra, comparison of self-adjoint variational and 36-group calculations of, 16: 24368
spectra, computer program for, 16: 24367
spectra in heavy crystalline media, 16: 24377
spectra, theoretical calculations, 16: 24938 (HW-71649)
THERMAL RADIATION
detection and measurement, equipment and methods for, 16: 23854 (WT-543)
detection and measurement using passive indicators, 16: 23855 (WT-544)
measurement techniques using infrared radiation, 16: 23973 (ANL-6515(p.163-86))
THERMAL REACTORS
fuel element testing in, for fast reactors, 16: 24641
THERMODYNAMICS
of reactor materials, conference, 16: 23694
statistical study of solid solutions for isotope separation, 16: 24084
THERMOELECTRIC CELLS
development of lead telluride for energy conversion, 16: 23831(R) (AD-269034)
properties evaluation for use outside earth's atmosphere, 16: 25029 (AD-269180)
THERMOELECTRIC MATERIALS
figure of merit, estimation of maximum, 16: 24186
THERMONUCLEAR EXPLOSIONS
earth deformation from underground, in salt beds, 16: 23357 (PNE-109F)
effects on communication systems, 16: 23994
THERMONUCLEAR REACTIONS
production by opposition of pinched hydrogen ion beams with electron injection, 16: 24895
production of dissociated plasma at 1.5 billion °K, 16: 24896
THERMONUCLEAR REACTORS
basic concepts, 16: 24444
blanket system design for, 16: 24890 (ORNL-3258)
plasma injection by Lorentz force, 16: 24446
power removal, 16: 24447
tritium production in, 16: 24448
THIAZINE DYES
radiosynthesis, 16: 23708 (CEA-1991)
THICKNESS GAGES
radiation, selection of isotope and source strength for, 16: 23860(T) (CEA-tr-A-1122)
THIOLS
preparation of sulfur-35-labeled organic, 16: 23550
THORIUM
coating, evaluation of materials and methods for, 16: 24133 (RFP-268)
determination, chromatographic and colorimetric, 16: 23653
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in rocks by gamma emission counting, 16: 23651
geology, bibliography of, 16: 24008 (STI/PUB/21/4)
processing, radioactivity distributions in metallurgical, 16: 23373 (TID-7616(p.3-38))
processing, survey of methods, 16: 23789 (ORNL-TM-241)
reactor criticality effects, 16: 24407
separation from ceramic fuels by phosfluor process, 16: 24645
separation from molten fluoride mixtures, 16: 23595
THORIUM BORIDES
corrosion and oxidation, 16: 24630

THORIUM CARBIDE–URANIUM CARBIDE SYSTEMS
fabrication of high-density, 16: 24119 (GAMD-2221)
THORIUM CARBIDES
corrosion and oxidation, 16: 24630
mechanical and thermal properties, 16: 24179(T,R) (AEC-tr-5174)
reactions with graphite at 1400 to 1800°C, 16: 24179(T,R) (AEC-tr-5174)
THORIUM FLUORIDES
electric and ionic conductivity at 1100°C, 16: 23672 (PAN-287/IV)
THORIUM ISOTOPES Th-226
recoil distributions and ranges from alpha reactions (α,4n) with radium-226 at 32.9 to 46.2 Mev, 16: 24853 (UCRL-9595-Rev.11)
THORIUM ISOTOPES Th-230
determination in uranium mill effluents, 16: 23383 (TID-7616(p.147-75))
THORIUM ISOTOPES Th-232
alpha fission at 25 Mev, fragments from, 16: 24351
determination in uranium mill effluents, 16: 23383 (TID-7616(p.147-75))
deuteron fission at 14 Mev, fragments from, 16: 24351
neon-22 reactions (neon-22, 4n), cross sections for, 16: 24781 (JINR-P-896)
neutron absorption resonance integrals, 16: 24391
THORIUM OXALATES
particle size determination in, method for, 16: 23775 (ORNL-TM-255)
THORIUM OXIDE–URANIUM OXIDE SYSTEMS
radiation effects, recrystallization behavior, 16: 24607
THORIUM OXIDES
thermal expansion at 100 to 1100°K, linear, 16: 24190
THORIUM(IV) OXIDES
diffusion of iodine-131, radon-222, and xenon-133 in, 16: 23674(T) (AEC-tr-5178)
diffusion of radon-222 and xenon-133 in, 16: 24183(T) (AEC-tr-5206)
particle size determination in, method for, 16: 23775 (ORNL-TM-255)
THORIUM SILICIDES
corrosion and oxidation, 16: 24630
THORIUM SULFIDES
fabrication and properties, 16: 24631
THULIUM
magnetic properties at 1.3°K to room temperature, 16: 24204
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
spectra, Zeeman effect of arc and spark type, 16: 24270 (AERE-R-4029)
THULIUM ISOTOPES Tm-170
decay, polarization of internal conversion electrons following beta, 16: 24784 (NP-11622)
gamma emission, 16: 24583
THYMIDINE
metabolism in tumor tissues, tracer study, 16: 23367
THYMUS
radiation effects on nucleoproteins in, 16: 23468
THYROID GLAND
radiation effects in dogs, partial or whole-body, 16: 23419 (UR-609)
radiation effects on iodine uptake, in rats, transcutaneous, 16: 23431
TIMING CIRCUITS
design for measurement of excited level lifetimes, 16: 24801
TIN
alloying effects on aluminum–niobium oxidation by air, 16: 24174 (TID-16032)
determination in zirconium by radioactivation analyses, 16: 23633 (TID-7629(p.239-44))
diffusion of liquid, neutron scattering studies of, 16: 24271 (AERE-R-4043)
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
TIN CRYSTALS
ultrasonic wave absorption in, 16: 23970 (ANL-6515(p.117-20))
TIN ISOTOPES Sn-113
energy levels and gamma spectra, 16: 24832
TIN ISOTOPES Sn-127
gamma spectra, half life, and mass, 16: 24805
TIN ISOTOPES Sn-128
gamma spectra, half life, and mass, 16: 24805
TIN, TETRAPHENYL-
vapor pressure and heat of sublimation, 16: 32589
TIN–ZIRCONIUM ALLOYS
bonding to type 410 stainless steel, 16: 24149(R) (BMI-X-204)
corrosion by chloride solutions, 16: 23528(R) (ORNL-3290)
corrosion by decontaminating solution, 16: 24496
corrosion of Zircaloy-2 and -4, by steam and hot water, 16: 24128 (WAPD-T-1281)
fabrication of tubes, 16: 24634
fabrication of Zircaloy-4 for CVTR pressure tube, 16: 24973 (CVNA-141)
radiation effects on mechanical properties of Zircaloy-2, 16: 24239 (HW-SA-2547)
sorptive properties of Zircaloy-2 and -4, for hydrogen, 16: 24128 (WAPD-T-1281)
TIRES
radiation effects on mechanical properties of cord, 16: 24262
TISSUES
gamma attenuation factors, 16: 23459
neutron flux measurements, in tissue-equivalent phantoms, 16: 23460 (AERE-R-3696)
removal of plutonium and americium, effectiveness of various chelating agents, 16: 23396
TITANIUM
alloying effects on aluminum–niobium oxidation by air, 16: 24174 (TID-16032)
corrosion by chloride solutions, 16: 23528(R) (ORNL-3290)
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
neutron cross sections at 0.025 ev to 18 Mev, 16: 24796 (UNC-5002)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
rolling of sheet, review of Department of Defense program, 16: 24159 (MAB-110-M(15))
TITANIUM ALLOYS
corrosion by acids at high temperature, 16: 24129
TITANIUM BORIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
TITANIUM CARBIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
TITANIUM CHLORIDES
spin-lattice relaxation in glycerine solutions at 77°K, 16: 23703
TITANIUM COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
TITANIUM COMPLEXES
formation and reactions in hydrochloric acid, 16: 23695
TITANIUM COMPOUNDS
preparation and properties of heteropoly acid containing molybdate, 16: 23680
preparation and properties of trivalent, 16: 23682
TITANIUM IONS
polarographic behavior in hydrochloric acid, 16: 23695
TITANIUM ISOTOPES Ti-45
yields in proton spallation of copper at 24 Bev, 16: 24859
TITANIUM ISOTOPES Ti-46
gamma-gamma directional correlation, 16: 24815
neutron reactions, cross section resonances, 16: 24818
TITANIUM ISOTOPES Ti-48
neutron reactions, cross section resonances, 16: 24818
TITANIUM ISOTOPES Ti-50
neutron reactions, cross section resonances, 16: 24818
TITANIUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
TITANIUM OXIDE CRYSTALS
dielectric constants at 70 to 5000 cm^{-1} in, 16: 24321
TOLUENE
radiation chemistry, 16: 23586
radiation effects at 5×10^6 to 5×10^8 rad, 16: 23352(R) (BNL-705)
radiolysis of deuterated, 16: 23546
reactions with polar compounds to form complexes, 16: 23533

solvent properties for mercury, 16: 23591
TRACER TECHNIQUES
book: *Radioactive Tracers in Chemistry and Industry*, 16: 24072(T)
description, using liquid scintillation measurements, 16: 24337
uses in coal processing, 16: 24035(R) (NYO-9851)
TRACER TECHNIQUES (AGRICULTURE)
radiation research in Latin America, 16: 23427
TRACER TECHNIQUES (CHEMICAL ENGINEERING)
applications survey, 16: 23728
calibration of isotopic neutron source for intrinsic-tracer process control, 16: 24570
use of radioactive clathrates for gas monitoring, 16: 24576
TRACER TECHNIQUES (CHEMISTRY)
applications in processing, survey, 16: 23728
for determining small solubilities, 16: 23706
gaseous reactions, 16: 23709 (JINR-P-957)
preparation of tritium-labeled olefins, 16: 24581
studies of reactions of inorganic complex compounds, 16: 23581
use of radioisotopes in studies of two-phase equilibria, 16: 23580
use of radioisotopes in studies of complex equilibria, 16: 23583
TRACER TECHNIQUES (ENGINEERING)
description for determining current efficiency of aluminum furnaces, 16: 23812
development for wear studies of turbo-assembly suspension bearings, 16: 24037(T) (AEC-tr-5189)
fc: gyro bearing lubrication problems, 16: 24582
TRACER TECHNIQUES (GEOLOGY)
applications in coastal engineering, 16: 23995
for study of ground water dispersion, 16: 25047 (TID-7628(p.166-78))
TRACER TECHNIQUES (MEDICINE)
for measurement of erythrocyte sensitization, 16: 23435
technique for localization of cardiac shunts, 16: 23368
TRACER TECHNIQUES (OCEANOGRAPHY)
measurement of sedimentation drift at Europort Harbor, 16: 24004
measurements of sedimentation drift, 16: 24001
TRANSISTORS
radiation effects on germanium p-n-p junction, gamma, 16: 24252
TRANSITION METALS
neutron magnetic scattering by alloys with simple metals, 16: 24333
solution chemistry, 16: 23529(R) (TID-16024)
TRANSURANIC ELEMENTS
production, 16: 24340
production, chemical requirements of, 16: 24342
separation from rare earths by amine extraction, 16: 24344
separation from rare earths by solvent extraction, 16: 23528(R) (ORNL-3290)
TREES
radioisotope accumulation in tissues, use in studying soil contamination, 16: 23406 (CEA-2131)
TRIOXANES
radioinduced solid-state polymerization, 16: 23744
TRITIUM
content in rainfall at Westwood, N. J., 1959–1961, 16: 23985 (NYO-9532)
determination by liquid scintillation counting, improvements in sensitivity by efficient light collectors, 16: 24578
determination using liquid scintillation counters, 16: 24337
deuteron reactions (d,n), neutron yields from, 16: 23964 (ANL-6515(p.9-27))
deuteron reactions (d,np) and (d,2n) at 6.7 to 9 Mev, neutron spectra, 16: 24821
exchange between succinate and water, 16: 23390
isotope effect in hydrogen sorption by Molecular Sieve 4A, 16: 23579
isotope effects in aldehyde reactions, 16: 23577
labeling of organic compounds, by electric discharge, 16: 23548
labeling of organic compounds, by electric discharge, 16: 23551
oxidation in air and oxygen, self-radiation effects, 16: 23717 (USNRDL-TR-565)
production in thermonuclear reactors, 16: 24448
reactions of recoil atoms with cyclic hydrocarbons, 16: 23549
TRITONS
momentum spectra from proton reactions with aluminum and beryllium at 30 and 33 Bev, 16: 24858
properties, matrix elements of quadratic LS operator for intrinsic, 16: 24833
TUBES
corrosion and scaling of stainless steel, by air and steam, 16: 24125
corrosion by steam at 1200 to 1500°F, 16: 24126
corrosion by steam of stainless steel, effects on heat-transfer properties, 16: 24127
fluid flow of boiling liquids in, 16: 23825
heat transfer and pressure drop in flow across tube bank, 16: 23826
heat transfer by free convection to fluid in vertical, 16: 23824
heat transfer in flow of boiling liquid in annulus, 16: 23828
TUMBLER OPERATION
thermal radiation measurements, equipment and methods for, 16: 23854 (WT-543)
thermal radiation measurements using passive indicators, 16: 23855 (WT-544)
TUMORS
screening of therapeutic agents, tracer method using tumor biopsy material, 16: 23367
TUNGSTEN
coating, development of oxidation-resistant materials for, 16: 24122(R) (NP-11700)
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in plutonium using dithiol, spectrophotometric, 16: 23620 (TID-7629(p.62-8))
determination in tantalum using thiocyanate, spectrophotometric, 16: 23619 (TID-7629(p.55-61))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
mechanical and physical properties at 4000 to 6000°F, 16: 24162 (NP-11654)
neutron removal cross sections for, effective fast, 16: 24797 (WADC-TR-58-266)
powder metallurgy, status of, 16: 24110(R) (MAB-139-M(C4))
shielding properties, 16: 25031 (JPL-TR-32-232)
specifications for sheet rolled, 16: 24160 (MAB-184-M)
welding, electron-beam, 16: 24131 (DMIC-Memo-152)
welding of lap joints in, 16: 24135(R) (WAL-460.54/1-1)
TUNGSTEN ALLOYS
specifications for sheet rolled, 16: 24160 (MAB-184-M)
TUNGSTEN ISOTOPES
neutron reactions (n,γ), spectra from, 16: 24840
TUNGSTEN ISOTOPES W-181
determination in stratosphere in Project Star Dust, 16: 23407(R) (DASA-1302)
TUNGSTEN ISOTOPES W-183
gamma spectra, 16: 24840
TUNGSTEN ISOTOPES W-184
gamma spectra, 16: 24840
TUNGSTEN ISOTOPES W-185
gamma spectra, 16: 24840
TUNGSTEN ISOTOPES W-187
gamma spectra, 16: 24840
TURBINES
evaluation for transmission systems for steam-powered submarines, 16: 23799 (AD-269398)

U

ULTRASONICS
absorption of waves in tin crystals, 16: 23970 (ANL-6515(p.117-20))
propagation in deformed materials, 16: 23971 (ANL-6515(p.121-32))
spectrometer for studying electron spin-phonon interactions in solids, 16: 23950
ULTRAVIOLET RADIATION
biological effects on *E. coli*, effects of dinitrophenol, 16: 23449
UNDERGROUND EXPLOSIONS
earth deformation from thermonuclear, in salt beds, 16: 23357 (PNE-109F)
UNITED STATES

nuclear power development, growth of, 16: 24978 (DL-49)
UPSHOT-KNOTHOLE OPERATION
blast effects on communal shelters in, instruments for measuring, 16: 23856 (WT-790)
gamma and neutron measurements in shelters, performance of instrumentation in, 16: 24016 (WT-789)
pressure effects in group shelters on animals and dummies, 16: 24017 (WT-798)
URANIUM
analysis for hydrogen for control in fuel processing steps, 16: 23639 (TID-7629(p.316-27))
analysis for zirconium by x-ray spectrometric methods, 16: 23621 (TID-7629(p.69-80))
analysis for zirconium by x-ray spectrometry, 16: 23655
compatibility with molybdenum alloys used as fuel cladding material, 16: 24145 (ANL-6268)
deformation of alpha/beta cycles under small stress, quantitative theory, 16: 24202
determination, absorptiometric, 16: 23653
determination in aqueous effluents using dibenzoylmethane, absorptiometric, 16: 23605 (PG-Report-186)
determination in herbaceous plants, absorptiometric, 16: 23606 (PG-Report-188)
determination in iron and steel alloys, methods for, 16: 23604 (NP-11873)
determination in irradiated fuel elements by gamma-excited x-ray spectra, 16: 24352
determination in milk, absorptiometric, 16: 23607 (PG-Report-187)
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in ores in field by gamma assaying, reliability, 16: 23992
determination in plants, rivers, and soils by precipitation, radiometric, 16: 23596 (AERE-R-3499)
determination in reactor fuel elements using radioisotope-excited x rays, 16: 23622 (TID-7629(p.81-90))
determination in rocks by gamma emission counting, 16: 23651
determination in urine, 16: 23380 (TID-7616(p.99-100))
determination in waste products from uranium–zirconium fuel element production, 16: 23637 (TID-7629(p.285-94))
determination using 1-(2-pyridylazo)-2-naphthol, complexometric, 16: 23600 (CNI-57)
diffusion in uranium dioxide, 16: 24183(T) (AEC-tr-5206)
dissolution in nitric acid, 16: 23536
geology, bibliography of, 16: 24008 (STI/PUB/21/4)
multiplication factor for 3% enriched, 16: 24434
neutron lifetimes in, fast, 16: 24424
neutron resonance capture integrals, 16: 24395
neutron resonance capture integrals, high-energy, 16: 24396
neutron resonance absorption, 16: 24759 (AE-77)
neutron scattering resonance cross sections for, fast, 16: 24387
phase transformations in, observations by high-temperature microscope, 16: 23839 (CEA-2082)
photoelectric effect, cross sections and polarization effects, 16: 24294
processing of irradiated, developments in solvent extraction processes for, 16: 23781 (HW-SA-2458)
radiation stability of beta-phase, 16: 24632
reactions with methane and propane to prepare uranium carbide, 16: 24168(R) (NYO-2694)
reactor criticality effects of irradiated, 16: 24382
reactor criticality effects, 16: 24407
separation by precipitation, 16: 23596 (AERE-R-3499)
separation by solvent extraction using a two-stage differential extraction procedure, 16: 24647
separation Durango acid leach solutions by ion exchange, 16: 23772 (ACCO-37)
separation from acid leach solutions by ion exchange and precipitation, 16: 23771 (ACCO-24)
separation from aqueous solutions by mixer-settlers, review, 16: 23793
separation from ceramic fuels by phosfluor process, 16: 24645
separation from leach ion exchange nitrate eluants by extraction with dibutyl butylphosphonates, 16: 23774 (NP-11877)
separation from leach solutions by ion exchange, 16: 23778 (ACCO-44)
separation from molten fluoride mixtures, 16: 23595
separation from plutonium by solvent extraction, 16: 23794
separation, quantitative TBP-petrol process for, 16: 23653
URANIUM CARBIDE–ZIRCONIUM CARBIDE SYSTEMS
physicochemical properties, 16: 24154(R) (GA-3245)
URANIUM CARBIDES
casting monocarbide pellets, 16: 24134 (TID-15337)
criticality studies, 16: 24419
diffusion of xenon-133 in, 16: 24183(T) (AEC-tr-5206)
exponential measurements in lattices, 16: 24984 (NAA-SR-Memo-7134)
preparation by graphite reactions with uranium dioxide and methane and propane reactions with uranium, 16: 24168(R) (NYO-2694)
properties as reactor fuel, economic, 16: 24453
radiation effects, 16: 24168(R) (NYO-2694)
radiation effects, 16: 24611
sintering, 16: 24629
sintering, effects of composition, 16: 24168(R) (NYO-2694)
URANIUM CHLORIDES
properties for use as fuel in fast breeder reactors, 16: 25002(T) (AEC-tr-5161)
URANIUM COMPLEXES
with aspartic, glutamic, and succinic acids, bonding and stability constants, 16: 23387 (UR-611)
URANIUM COMPOUNDS
analysis for 25 trace elements by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
separation by solvent extraction, 16: 23796
surface area measurements, evaluation of sorptometer for, 16: 23640 (TID-7629(p.331-44))
URANIUM CONCENTRATES
analysis for fluoride, method for, 16: 23608 (PG-Report-228)
URANIUM(IV) FLUORIDES
analysis for uranyl fluoride, absorptiometric, 16: 23609 (PG-Report-323)
preparation from reaction of uranium(VI) oxide with dichlorodifluoromethane, reaction mechanism, 16: 23679
URANIUM(IV) IONS
reactions with uranium(VI) ions in solution, electron exchange, 16: 23572
URANIUM(VI) IONS
determination in solutions, spectrophotometric, 16: 23644
reactions with uranium(IV) ions in solution, electron exchange, 16: 23572
URANIUM ISOTOPES U-232
separation from protactinium-231, 16: 23528(R) (ORNL-3290)
URANIUM ISOTOPES U-233
alpha fission at 25 Mev, fragments from, 16: 24351
deuteron fission at 14 Mev, fragments from, 16: 24351
economics as power reactor fuel, 16: 24483
fission yield data evaluation, 16: 24792 (ORNL-3305)
neutron cross sections, 2200-m/sec, 16: 24383
reactor criticality effects, 16: 24407
reactor criticality effects, 16: 24408
spectra, determination of hyperfine structure from infrared, 16: 24336
URANIUM ISOTOPES U-235
alpha fission at 25 Mev, fragments from, 16: 24351
determination by spectroscopy, development of instrument for, 16: 23616 (TID-7629(p.22-30))
deuteron fission at 14 Mev, fragments from, 16: 24351
fission by thermal and 5-Mev neutrons, comparison of energy of products from, 16: 24809
neutron cross sections, 2200-m/sec, 16: 24383
neutron fission fragment masses below 0.5 ev, 16: 24349
neutron fission, relations of fission neutrons emitted to absorbed neutrons and the number of prompt emissions at 6 ev to 50 ev incident, 16: 24790 (NRDC-123)
neutron inelastic removal cross sections, 16: 24408
neutron resonance fission yields, 16: 24347
reactor criticality effects, 16: 24407
reactor criticality effects, 16: 24408
URANIUM ISOTOPES U-236
alpha fission fragment yield ratios, 16: 24346
neutron fission fragment yield ratios, 16: 24346
URANIUM ISOTOPES U-238
alpha fission at 25 Mev, fragments from, 16: 24351

deuteron fission at 14 Mev, fragments from, 16: 24351
fission product yields from fast neutron fission, 16: 24779 (CRRP-1090)
neutron absorption resonance integrals, 16: 24391
neutron capture and fast fission, 16: 24429
neutron inelastic removal cross sections, 16: 24408
neutron resonance capture integrals, 16: 24395
neutron resonance capture integrals, high-energy, 16: 24396
neutron resonance integrals in rods and lattices, 16: 24764 (WAPD-T-1497)
neutron resonances, statistical errors in flux level parameters in, 16: 24771
oxygen-16 reactions (oxygen-16, 4n), cross sections for, 16: 24781 (JINR-P-896)
URANIUM LEACH SOLUTIONS
separation of copper and uranium from acid, by ion exchange and precipitation, 16: 23771
URANIUM LEACH SOLUTIONS (ACID)
analysis for radium-226 and thorium-230 and -232, 16: 23383 (TID-7616(p.147-75))
filtration, development of glue substitute for use in, 16: 23769 (ACCO-2)
processing Durango, by ion exchange, 16: 23772 (ACCO-37)
processing Gunnar, by ion exchange, 16: 23778 (ACCO-44)
processing ion exchange nitrate eluents by extraction with dibutyl butylphosphonate, 16: 23774 (NP-11877)
URANIUM NITRIDE COMPACTS
preparation of mononitride by reaction hot pressing, 16: 24136
URANIUM ORE PROCESSING PLANTS
effluent analysis, 16: 23383 (TID-7616(p.147-75))
URANIUM ORES
analysis for fluoride, method for, 16: 23608 (PG-Report-228)
analysis for uranium by gamma assaying, reliability, 16: 23992
leaching Rum Jungle, acid, 16: 23771 (ACCO-24)
processing by ion exchange and leaching, 16: 23770(R) (ACCO-17)
processing in Hungary, by acid and carbonate leaching methods, 16: 23795
URANIUM(IV) OXIDE COMPACTS
coating with pyrolytic carbon, 16: 24626
diffusion of fission gas from irradiated, continuous, 16: 24219
oxidation, 16: 24622
radiation effects, 16: 24458
radiation effects on aluminum alloy clad, 16: 24463
thermal testing, out-of-pile, 16: 24620
URANIUM(IV) OXIDE CRYSTALS
radiation effects, 16: 24608
URANIUM(IV) OXIDE POWDERS
compacting, vibratory, 16: 24621
fabrication by pressing and sintering, 16: 24099(R) (EURAEC-57 (App.2))
preparation for Fiat (Turin), 16: 24101(R) (EURAEC-57(App.4))
preparation for sintering, 16: 24098(R) (EURAEC-57(App.1))
sintering in wet hydrogen atmosphere, development of equipment for, 16: 24102(R) (EURAEC-57(App.5))
URANIUM OXIDE SLURRIES
hydrodynamics of, in homogeneous power reactor, 16: 25003(T) (AEC-tr-5198)
URANIUM(IV) OXIDE–WATER SYSTEMS
neutron multiplication in, comparison of analytical and cadmium-ratio, 16: 24426
URANIUM(IV) OXIDE–WATER-d_2 SYSTEMS
neutron buckling and void effects in, 16: 24414
neutron multiplication factor for, 16: 24427
URANIUM OXIDE–ZIRCONIUM OXIDE SYSTEMS
differential thermal analysis, 16: 23652
URANIUM(IV) OXIDE–ZIRCONIUM OXIDE SYSTEMS
coating with pyrolytic carbon, 16: 24626
radiation effects, 16: 24616
URANIUM OXIDES
neutron resonance absorption, 16: 24759 (AE-77)
reduction using ammonia, carbon monoxide, and hydrogen, thermodynamic characteristics, 16: 24187
sintering, design of furnace for, 16: 24100(R) (EURAEC-57(App.3))
URANIUM OXIDES (CLAD)
radiation effects on, with beryllium cladding, 16: 24613
radiation effects, 16: 24235 (CRFD-1084)
URANIUM OXIDES (STAINLESS STEEL CLAD)
radiation effects, axial expansion of the uranium dioxide, 16: 24609
radiation effects, high temperature behavior in water during, 16: 24617
radiation effects, 16: 24618
URANIUM OXIDES (Zr ALLOY CLAD)
radiation effects, axial expansion of the uranium dioxide, 16: 24609
URANIUM(IV) OXIDES
analysis of irradiated for molybdenum and neodymium to determine burnup, 16: 23626 (TID-7629(p.152-65))
diffusion of krypton-85, radon-222, uranium, and xenon-133 in, 16: 24183(T) (AEC-tr-5206)
melting in fuel elements, 16: 24624
neutron resonance capture integrals, 16: 24395
production by flame denitration and reduction of aqueous uranyl nitrate, pilot plant for, 16: 23773 (MCW-1470)
production from uranyl carbonate, 16: 23777(P)
properties as reactor fuel, economic, 16: 24453
radiation effects, high temperature substoichiometry following, 16: 24620
radiation effects, in-pile fission gas release, 16: 24614
radiation effects, fission product release by in-pile melting, 16: 24615
radiation effects, beach loop for study, 16: 24106(R) (EURAEC-57 (App.9))
sintering for irradiation testing, 16: 24097(R) (EURAEC-57)
sintering to densities of 10.2, 10.4, and 10.6, 16: 24105(R) (EURAEC-57(App.8))
thermal conductivity, preparation of samples for measurement by radial flow, 16: 24104(R) (EURAEC-57(App.7))
thermal shock resistance of extruded and sintered, 16: 24103(R) (EURAEC-57(App.6))
URANIUM(IV-VI) OXIDES
chlorination in halide systems (liquid), 16: 23663 (ANL-6546)
differential thermal analysis at 1100 to 1500°C, 16: 23652
diffusion of krypton-85, radon-222, and xenon-133 in, 16: 24183(T) (AEC-tr-5206)
production by thermal decomposition of ammonium diuranate, uranium peroxide, and uranyl nitrate, 16: 23776(T) (AEC-tr-4939)
sedimentation rate of suspensions, effects of electrokinetic potential on, 16: 23699
URANIUM(VI) OXIDES
multiplication factor for 3% enriched, 16: 24434
production by thermal decomposition of ammonium diuranate, uranium peroxide, and uranyl nitrate, 16: 23776(T) (AEC-tr-4939)
reaction with dichlorodifluoromethane to produce uranium(IV) fluoride, mechanism, 16: 23679
reduction to uranium dioxide, 16: 24098(R) (EURAEC-57(App.1))
URANIUM PEROXIDES
thermal decomposition, formation of uranic acid in, 16: 23776(T) (AEC-tr-4939)
URANIUM SILICIDE COMPACTS
preparation of U_3Si_2 by reaction hot pressing, 16: 24136
URANIUM SULFIDES
fabrication and properties, 16: 24631
URANIUM–URANIUM NITRIDE SYSTEMS
sintering by hot pressing, reaction, 16: 24136
URANIUM–URANIUM OXIDE SYSTEMS
chlorination in halide systems (liquid), 16: 23663 (ANL-6546)
URANIUM–WATER SYSTEMS
criticality studies in critical and subcritical assemblies, 16: 24354
kinetics of enriched lattices, 16: 23352(R) (BNL-705)
neutron resonance capture integrals, high-energy, 16: 24396
URANIUM–WATER-d_2 SYSTEMS
criticality studies, 16: 24355
neutron capture and fast fission, 16: 24429
neutron flux distributions in, 16: 24430
neutron multiplication in, effects of reflectors and voids on, 16: 24415
URANIUM–ZIRCONIUM ALLOYS (Zr ALLOY CLAD)
dimensional stability of tubular, radiation effects at 1280 Mwd/t, 16: 24237 (DP-709)
URANYL ACETATE COMPLEXES
bonding and stability constants, 16: 23387 (UR-611)

URANYL CARBONATES
reduction to dioxide, 16: 23777(P)
URANYL FLUORIDES
determination in uranium tetrafluoride, absorptiometric, 16: 23609 (PG-Report-323)
reduction using ammonia, carbon monoxide, and hydrogen, thermodynamic characteristics, 16: 24187
URANYL IONS
reactions with Dowex 50 resin cation exchanger, equilibrium constants, 16: 23534
URANYL NITRATES
conversion to uranium dioxide by flame denitration and reduction, pilot plant for, 16: 23773 (HCW-1470)
solvent extraction by tributyl phosphate, mechanism, 16: 23797
thermal decomposition, formation of uranic acid in, 16: 23776(T) (AEC-tr-4939)
URANYL SULFATE COMPLEXES
hydrometallurgical studies, 16: 23770(R) (ACCO-17)
URINE
analysis for curium by electrodeposition, 16: 23374 (TID-7616(p.39-50))
analysis for neptunium-237, evaluation of methods for, 16: 23375 (TID-7616(p.51-9))
analysis for tritium water by scintillation counting, 16: 23642 (UCLA-504)
analysis for uranium using 1-(2-pyridylazo)-2-naphthol, complexometric, 16: 23600 (CNI-57)
analysis for uranium, 16: 23380 (TID-7616(p.99-100))
radioinduced creatinuria, etiology, 16: 23463

V

VALVES
development of bearings for D-103 by-pass, 16: 23801 (DC-60-1-37)
VAN ALLEN RADIATION BELTS
diamagnetism, as source of external geomagnetic field, 16: 24663
dosimetry of energetic radiation in, data survey on, 16: 24013 (NASA-TN-D-1267)
VANADIUM
determination in biological materials, activation, 16: 23403
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
separation from uranium leach solutions (acid) by ion exchange, 16: 23772 (ACCO-37)
VANADIUM BORIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
VANADIUM CARBIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
VANADIUM ISOTOPES V-47
yields in proton spallation of copper at 24 Bev, 16: 24859
VANADIUM ISOTOPES V-48
yields in proton spallation of copper at 24 Bev, 16: 24859
VANADIUM ISOTOPES V-49
yields in proton spallation of copper at 24 Bev, 16: 24859
VANADIUM ISOTOPES V-51
neutron reactions (n,γ), activation measurements for, 16: 24787 (NP-11793)
VANADIUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24208
VERMICULITES
reactions with strontium, tracer studies, 16: 25049 (TID-7628(p.187-97))
VESPIDAE
hatchability of Habrobracon eggs, postirradiation effects of carbon monoxide and nitrogen on, 16: 23452 (BNL-4981)
VISION
radiation effects, 16: 23500
VITAMIN B_{12}
content and retention of cobalt-60 labeled-, in dog liver, 16: 23397 (BNL-4888)

W

WARFARE
book: *Nuclear War and Nuclear War Protection*, 16: 24032(T)
WASTE DISPOSAL
bibliography, 16: 23784 (ORNL-2971(Vol.1))
bibliography, 16: 23785 (ORNL-2971(Vol.3))
by ground storage, 16: 25040 (TID-7628(p.12-16))
by injection into permeable rocks, 16: 25056 (TID-7628(p.324-46))
conference on ground disposal, 16: 25037 (TID-7628)
cost studies of interim liquid storage and pot calcination, 16: 25072 (TID-7628(p.532-5))
deep-well injection, survey of geologic basins in U. S., 16: 25057 (TID-7628(p.347-55))
deep well injection, 16: 25058 (TID-7628(p.356-62))
design and operation of deep injection wells, 16: 25059 (TID-7628(p.363-73))
from isotope laboratories, dilution and storage calculations, 16: 25077
ground burial, site selection and operation, 16: 25063 (TID-7628(p.428-36))
ground storage, 16: 25041 (TID-7628(p.67-76))
ground storage, 16: 25043 (TID-7628(p.99-114))
ground storage, 16: 25069 (TID-7628(p.491-505))
ground storage, 16: 25071 (TID-7628(p.513-31))
ground storage, 16: 25073 (TID-7628(p.536-68))
ground storage, geohydrologic factors, 16: 25042 (TID-7628(p.77-98))
ground storage, safety, 16: 25070 (TID-7628(p.506-12))
in ground at Savannah River Plant, 16: 25044 (TID-7628(p.115-25))
in seepage pits, percolation of plutonium species in soil, 16: 25054 (TID-7628(p.248-81))
in underground mined caverns, 16: 25061 (TID-7628(p.380-95))
injection into deep sandstone formations, 16: 25055 (TID-7628(p.303-23))
land burial, 16: 25062 (TID-7628(p.396-427))
land burial, 16: 25064 (TID-7628(p.437-59))
land burial, effects of bentonite on permeability of soil by moisture, 16: 25066 (TID-7628(p.462-8))
land burial, site survey in northeastern U. S., 16: 25065 (TID-7628 (p.460-1))
possibilities at Ispra, Italy, 16: 25074 (TID-7628(p.569-82))
practices in Great Britain, 16: 25075 (TID-7628(p.583-9))
research programs of the International Atomic Energy Agency, 16: 25076 (TID-7628(p.590-601))
solid storage in solidified glass, monitoring of activity from, 16: 25039 (TID-7628(p.9-12))
storage in mined-out salt mines, 16: 25067 (TID-7628(p.469-76))
storage in mined-out salt mines, 16: 25068 (TID-7628(p.477-90))
through boreholes to sub-surface areas, 16: 25060 (TID-7628(p.374-9))
to ground, facilities at Chalk River plant, 16: 25038 (TID-7628(p.3-9))
WASTE PROCESSING
ground storage, insolubilization using petroleum tar, 16: 25050 (TID-7628(p.198-210))
pilot plant and techniques for solids, 16: 25034 (CEA-2147)
precipitation of calcium and magnesium prior to foam separation, 16: 25036 (ORNL-TM-260)
removal of strontium by calcite-phosphate column, 16: 25051 (TID-7628 (p.211-13))
research programs of the International Atomic Energy Agency, 16: 25076 (TID-7628(p.590-601))
scavenging by ion exchange materials, 16: 25053 (TID-7628(p.237-47))
soil sorption and retention, 16: 25052 (TID-7628(p.214-36))
sorption method using peat, 16: 25078
sorption of cesium and strontium on Victorian brown coal, 16: 25033 (AAEC/TM138)
sorption of radioisotopes from reactor effluent on minerals, 16: 25035 (HW-69225)
sorption of strontium by minerals, 16: 25049 (TID-7628(p.187-97))
uranium recovery in, 16: 23637 (TID-7629(p.285-94))
WASTE SOLUTIONS
analysis for barium, calcium, and strontium in strontium-90, methods for, 16: 23601 (HW-69677)
processing for americium and curium recovery, 16: 24343
separation of solid suspensions from uranium, methods for, 16: 23385 (TID-7616(p.223-34))

WATER
analysis for dissolved oxygen, 16: 23610 (PG-Report-335)
analysis for isotopes, book, 16: 23661
analysis for oxygen, radiometric, 16: 24577
boiling, velocity of rising steam in, 16: 24510
determination in building materials by gamma absorption, 16: 24048
determination in soil by nuclear methods, bibliography, 16: 23982 (AERE-Bib-140)
diffusion, neutron scattering studies of, 16: 24271 (AERE-R-4043)
gamma scattering at 0.66 Mev, energy distributions from, 16: 24693 (NP-11538)
neutron attenuation by boron-containing, 16: 24366
neutron diffusion lengths in, calculational model for, 16: 24373
neutron diffusion and thermalization at 0.5 to 286°C, 16: 24765(T) (AEC-tr-5143)
partition between aqueous and tributyl phosphate–hexane phase, 16: 24646
properties as reactor coolant, 16: 23830 (BNL-5377)
purification with cobalt-60, 16: 24054
radioactivity measurement devices, 16: 23868
separation of cesium and strontium from, using Victorian brown coal, 16: 25033 (AAEC/TM138)
solvent properties for silver halides and strontium thiocyanate, 16: 23706
solvent properties for strontium sulfate, effects of particle size, 16: 23592
tritium exchange with succinate, 16: 23390
volatilities of oxygen-16, -17, and -18 labeled, relative, 16: 23667 (IA-728)
x-ray scattering at 50 to 250 kev by slabs of, spectra, 16: 24293
WATER-d,
analysis for isotopic purity, apparatus for continuous, 16: 23623 (TID-7629(p.91-109))
biological effects on bacteria, 16: 23388
biological effects on bacteria, 16: 23404
effects on enolization of oxalacetic acid, 16: 23532
metabolic effects on algae, 16: 23364
neutron attenuation by boron-containing, 16: 24366
neutron diffusion coefficients in, at 20 to 220°C, 16: 24374
neutron incoherent scattering, model for thermal, 16: 24379
photoneutron production in, by delayed gammas following uranium-235 irradiation, 16: 24495
properties as reactor coolant, 16: 23830 (BNL-5377)
WATER-t
determination in urine by scintillation counting, 16: 23642 (UCLA-504)
WATER-t,
radiation from gaseous in air, health hazards, 16: 23717 (USNRDL-TR-565)
WATER COOLED REACTORS
design study of advanced indirect cycle for maritime uses, 16: 24971 (CEND-150(Pt.I))
WATER MODERATED REACTORS
control rod economics, 16: 24485
design study of advanced indirect cycle for maritime uses, 16: 24971 (CEND-150(Pt.I))
neutron flux distribution in, internal thermal columns for amplifying, 16: 24955
neutron multiplication in, comparison of analytical and cadmium-ratio, 16: 24426
neutron thermal utilization in, 16: 24425
WATER SUPPLIES
cesium-137 and strontium-90 content in United Kingdom, 1961, 16: 24033
contamination by fall-out after nuclear attack, radiation hazards from, 16: 24014 (NP-11715)
WEAR
of tool for punching sheet metal, 16: 24068
tracer study in turbo-assembly suspension bearings by tracer methods, 16: 24037(T) (AEC-tr-5189)
WELDED JOINTS
radiography of steel plate, for flaws, 16: 24058
WELL LOGGING
equipment and methods for study of waste-disposal hydrology, 16: 25043 (TID-7628(p.99-114))
nuclear magnetic resonance apparatus, 16: 23961(P)
WELLS
deep injection waste disposal, site survey, 16: 25057 (TID-7628(p.347-55))
design and operation of deep injection waste disposal, 16: 25059 (TID-7628(p.363-73))
operation of deep injection waste disposal, 16: 25058 (TID-7628(p.356-62))
WHEAT
radiation effects on flour, 16: 24041
WIND TUNNELS
design study of arc-jet simulated hypersonic, 16: 24885 (ASD-TR-61-283)
WOOL
radiation effects on mechanical properties, 16: 24257

X

X RADIATION
absorption by concretes, lead, and steel, 16: 24223
absorption by elements, for coefficients, 16: 23966 (ANL- 6515(p.53-80))
biological effectiveness in tissue-equivalent phantom, relative, 16: 23448
dosimetry, advantages and basic principles of film, 16: 24028
effects of whole-body exposure on bactericidal activity of phagocytin, 16: 23462
effects on behavior, 16: 23513
effects on bioelectric activity of nerves, 16: 23503
effects on blood plasma protein in man, 16: 23412 (CEA-2132)
effects on blood vessel control, whole-body exposure, 16: 23438
effects on brain, damage sequence in mice, 16: 23481
effects on brain growth, 16: 23477
effects on brain of fetal rats, 16: 23473
effects on central nervous system, 16: 23480
effects on cervical nerves, whole-body exposure, 16: 23442
effects on cytology and structure of bone marrow in rats, whole-body, 16: 23429 (BNL-5032)
effects on dogs, partial and whole-body, 16: 23419 (UR-609)
effects on function of hematopoietic system, 16: 23445
effects on function and growth of regenerated or transplanted adrenocortical tissue in rat, 16: 23417(R) (TID-16122)
effects on glutamic dehydrogenase within and without intact mitochondria, 16: 23456
effects on hematoencephalic barrier and cerebral blood vessels, 16: 23493
effects on iron metabolism in blood, whole-body exposure, 16: 23430
effects on learning behavior, *in utero* exposure, 16: 23507
effects on leukocyte count, variations with dose, 16: 23446
effects on mammalian retina, 16: 23501
effects on mice, protective effects of AET against, 16: 23517
effects on morphology of fertilized ova and embryo development in hamster, ova exposure, 16: 23416 (TID-16121)
effects on nervous system of monkeys and rats, demyelination, malacic myelopathy, and myodegeneration, 16: 23483
effects on nervous system, survey of Russian work, 16: 23487
effects on neural tube of chick embryo, 16: 23476
effects on newborn, head exposure, 16: 23475
effects on oöcyte maturation in mice, 16: 23520
effects on phosphorus content in microsomal lipoproteins in rats, 16: 23450
effects on rats, head exposure, 16: 23474
effects on synthesis of creatine by liver, whole-body exposure, 16: 23463
effects on thyroid function in rats, 16: 23431
field boundary and scatter at 200 kv, 16: 24026
genetic effects in wheat seeds, 16: 23454
lethal effects, effects of previously administered radioisotopes, 16: 23443
lethal effects on grasshopper embryos, 16: 23413 (TID-15962)
neurological effects on nervous system of rats, 16: 23420 (USNRDL-TR-561)
neurological effects on brains of pigeons and rabbits, comparison of sensitivity of various parts, 16: 23421(T) (AEC-tr-5141)

photoeffect on massive cathodes, mechanisms, 16: 24328
protection against, review, 16: 24034
scattering by water slabs at 50 to 250 kev, spectra, 16: 24293
use in radiography of shipbuilding materials, 16: 24067
X-RAY BEAMS
production in linear accelerators, 16: 23976 (ANL-6515(p.218-47))
X-RAY DIFFRACTOMETERS
design for high-temperature operation, 16: 23837 (ARL- 62-315)
X-RAY SHIELDING
fluxes and spectra behind water slabs, for 50- to 250-kev photons, 16: 24293
X-RAY SPECTROMETERS
design and performance of roller, 16: 23948
XENON
alkali-atom electron-spin-resonance spectra in, at 4.2°K, 16: 23702
diffusion and sorption in high-density graphite at 750 and 1000°C, 16: 23700
diffusion from graphite–thorium carbide–uranium carbide systems, 16: 24628
diffusion in alumina, effects of fission recoil damage, 16: 24619
electric discharge in, channel brightness, 16: 24289(T) (NP-tr-898)
enthalpy–entropy diagram for, at 0 to 150°C, 16: 23701
ionization by metastable helium atoms, cross sections, 16: 24296
mesons (π^-) reactions at 2.8 Bev, angular distribution and cross sections for, 16: 24695 (NP-11757)
XENON ISOTOPES
diffusion from irradiated uranium dioxide, 16: 24219
XENON ISOTOPES Xe-133
diffusion from neutron irradiated uranium oxide compacts, 16: 24144 (AERE-R-4062)
diffusion in thorium and uranium oxides and uranium carbide, 16: 24183(T) (AEC-tr-5206)
diffusion in thorium dioxide, 16: 23674(T) (AEC-tr-5178)
diffusion in uranium carbide, 16: 24184(T) (AEC-tr-5213)
yields from fission reactions, 16: 24351
XENON ISOTOPES Xe-135
diffusion from neutron irradiated uranium oxide compacts, 16: 24144 (AERE-R-4062)
diffusion in uranium carbide, 16: 24184(T) (AEC-tr-5213)
yields from fission reactions, 16: 24351

Y

YANKEE POWER REACTOR
control rod worth, 16: 24469
control rod worth, 16: 24404
core-I instrumentation, 16: 24470
core-I reactivity, 16: 24471
core-I reactivity, 16: 24472
fuel cycle development, 16: 24468
operational experience, 16: 24466
performance, 16: 24467
YEASTS
radiation resistance, 16: 24043
YTTERBIUM
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
spectra, Zeeman effect of arc and spark type, 16: 24270 (AERE-R-4029)
YTTERBIUM ACETATES
preparation of anhydrous, by desolvation, 16: 23697
YTTERBIUM HYDRIDES
properties, 16: 23686
YTTERBIUM IONS
spectra in cadmium fluoride crystals, absorption and electron paramagnetic resonance, 16: 24334
YTTERBIUM ISOTOPES Yb-169
gamma emission, 16: 24583
use in radiography, 16: 24584
YTTERBIUM ISOTOPES Yb-175
beta decay scheme, 16: 24808
YTTERBIUM SULFATES
crystal structure and magnetic properties at 100 to 300°K, 16: 24304
YTTRIUM
properties, structure, and uses review, 16: 24201 (IS-222)
separation by ion exchange and elution with alpha-hydroxy acids, 16: 23571
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
YTTRIUM ACETATES
preparation of anhydrous, by desolvation, 16: 23697
YTTRIUM CRYSTALS
thermal expansion at 4.2 to 273°K, anisotropic, 16: 24193
YTTRIUM FLUORIDES
solubility in molten fluoride mixtures, 16: 23595

Z

ZINC
determination in biological materials, activation, 16: 23403
determination in niobium and zirconium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in ointments and pastes by beta backscattering, 16: 24065
determination in uranium compounds by reversed-phase partition chromatography, 16: 23636 (TID-7629(p.276-84))
mesic atoms of, meson (μ^-) decay in, 16: 24278 (JINR-P-971)
meson (μ) decay in, 16: 24819
movement in peppermint plant, 16: 23389
properties of liquid, as reactor coolant, 16: 23830 (BNL-5377)
ZINC CHLORIDES
displacement by cadmium chloride on anion exchangers, frontal analysis and development, 16: 23673(T) (AEC-tr-5098)
ZINC COATINGS
development for tantalum alloy and metal protection, 16: 24148(R) (ASD-TR-61-676)
ZINC CRYSTALS
thermal expansion at 4.2 to 273°K, anisotropic, 16: 24193
ZINC ISOTOPES Zn-62
yields in proton spallation of copper at 24 Bev, 16: 24859
ZINC ISOTOPES Zn-64
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
ZINC ISOTOPES Zn-65
separation from water by adsorption on minerals, 16: 25035 (HW-69225)
yields in proton spallation of copper at 24 Bev, 16: 24859
ZINC ISOTOPES Zn-66
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
ZINC ISOTOPES Zn-67
energy levels, hyperfine structure of metastable ^2P, 16: 24849
ZINC ISOTOPES Zn-68
alpha inelastic scattering, excitation by, 16: 24777 (CEA-2146)
ZINC TITANATES
radiation effects on electric conductivity, slow-neutron, 16: 24266
ZIRCONIUM
adsorption on peat, 16: 25078
alloying effects on aluminum–niobium oxidation by air, 16: 24174 (TID-16032)
analysis for 8 elements by neutron activation, 16: 23633 (TID-7629 (p.239-44))
determination in niobium by radioactivation analysis, 16: 23633 (TID-7629(p.239-44))
determination in refined uranium materials, x-ray spectrometric, 16: 23621 (TID-7629(p.69-80))
determination in uranium by x-ray spectrometry, 16: 23655
determination, photometric, 16: 23653
determination using phenyl-phosphonic acid, gravimetric, 16: 23660
neutron scattering resonance cross sections for, fast, 16: 24387
separation from hafnium in sulfuric solution by anion exchange, 16: 23792(T) (AEC-tr-5099)
separation from uranium fuel solutions by precipitation with sodium formate, 16: 23782 (IDO-14582)
separation of fission product, radiochemical, 16: 24564
solubility in bismuth at 300 to 700°C, 16: 24216
ZIRCONIUM ALCOHOLATES
isopropoxide and tetra-tert butoxide, pyrolysis and synthesis, 16: 24147 (ASD-TDR-62-90)

ZIRCONIUM ALLOYS
corrosion by steam at 750°F and water at 680°F, 16: 24117(R) (ARF-2198-28)
ZIRCONIUM BROMIDES
structure of trivalent, 16: 23682
ZIRCONIUM CARBIDE COMPACTS
thermal shock resistance, 16: 24176 (WADD-TR-60-749(Pt.II))
ZIRCONIUM CARBIDES
thermal conductivity at 530 to 2100°C, 16: 24192
ZIRCONIUM CHLORIDES
reactions with potassium chloride, tracer study of gaseous, 16: 23709 (JINR-P-957)
structure of trivalent, 16: 23682
ZIRCONIUM HYDRIDES
neutron spectra in, temperature coefficient of, 16: 24380
neutron spectra in, temperature coefficient of, 16: 24381
ZIRCONIUM IODIDES
structure of trivalent, 16: 23682
ZIRCONIUM ISOTOPES Zr-95
determination in cesium-137 sulfate, 16: 23631 (TID-7629(p.209-16))
ZIRCONIUM NITRIDES
thermal conductivity, effects of electronic and crystalline structure, 16: 24358
ZIRCONIUM OXIDE COATINGS
deposition on graphite, 16: 24147 (ASD-TDR-62-90)
ZIRCONIUM OXIDE COMPACTS
fabrication, 16: 24138
ZIRCONIUM OXIDES
electric properties of oxygen deficient, 16: 24141(R) (AD-270235)
spectra, rotational constants for $a(C \rightarrow X)$ band system, 16: 24303
thermal stabilization using calcium and magnesium oxides, effects of iron oxide on, 16: 24203
ZIRCONIUM PHOSPHATES
sorptive properties, for chromatography of inorganic ions, 16: 23650
ZIRCONYL SULFIDES
structure of tetragonal, 16: 23676

REPORT NUMBER INDEX

All reports, translations, and patents abstracted in this issue are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show, when known, which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. The report numbers for the non-AEC reports in these series are marked with an asterisk (*). Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(2nd Rev.), *Report Number Series Used by the Technical Information Service in Cataloging Reports*. March 1960, $2.75 (OTS), and supplement, August 1960, $0.50 (OTS).

Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories, many of which have facilities for preparing photocopy for sale, appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin.

(4) Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., for sale as full-size printed copy, photostat or facsimile (Xerox), and microfilm.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for sale as full-size printed copy.

Public Availability of Non-AEC Reports

U. S. Reports. Many reports of U. S. Government agencies other than the AEC can be obtained by the public in the same manner as AEC reports. The availability of these reports is given when known. If availability is not shown, inquiries should be directed to the Office of Technical Services. Inquiries concerning "NP" reports should be by title and author rather than by NP number.

Non-U. S. Reports. Many reports of atomic energy establishments of other countries are placed in the depository libraries in the United States, where they are available for public use. Other reports appear in the journal literature. Some British reports are sold by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y. Some Canadian reports are sold by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada. This index identifies any type of public availability known to the USAEC.

Abbreviations Used in Availability Column

AECL	For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada.
BIS	For sale by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y.
Dep.	AEC reports: Full-size copy is on deposit in the depository libraries both in and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin. Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only.
Dep.(mc)	Same as for Dep., except copy is in Microcard form.
DSIR	For sale by the Department of Scientific and Industrial Research, Lending Library Unit, 20 Chester Terrace, London, N. W. 1, England.
DTI Extension	Available from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee.
GPO	For sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C.
IAEA	Available from the International Atomic Energy Agency.
JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
OTS	For sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C.
USGS	Available free-of-charge from the U. S. Geological Survey, Washington 25, D. C.

(The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile (Xerox) form.)

Report No.	Abstract No.	Availability
NUMERICAL	(Misc.)	
SFGL77*	16-24233	
AAEC/E–	(Australian)	
89	16-24929	Dep.(mc)
AAEC-TM–	(Australian)	
138	16-25033	Dep.(mc)
ACCO–		
2	16-23769	Dep.(mc); $1.60(fs), $0.80(mf) OTS
17	16-23770	Dep.(mc); $9.10(fs), $3.29(mf) OTS
24	16-23771	Dep.(mc); $1.60(fs), $0.80(mf) OTS
37	16-23772	Dep.(mc); $2.60(fs), $0.83(mf) OTS
44	16-23778	Dep.(mc); $3.60(fs), $1.13(mf) OTS
ACNP–		
5905	16-24961	Dep.(mc); $26.00(fs), $10.46(mf) OTS
62005	16-24962	Dep.(mc); $8.60(fs), $3.05(mf) OTS
AD–	(Misc.)	
155598*	16-24797	See WADC-TR-58-266
264767*	16-15030	See AFOSR-1632
266543*	16-24172	See SSC-137
267097*	16-24891	See RADC-TN-61-222
268830*	16-24135	See WAL-460.54/1-1
269034*	16-23831	OTS
269134*	16-23853	See WADD-TN-60-307
269180*	16-25029	OTS
269206*	16-24885	See ASD-TR-61-283
269265*	16-24139	OTS
269390*	16-23798	OTS
269398*	16-23799	OTS
269399*	16-23800	OTS
269402*	16-24963	OTS
269659*	16-24880	See AFCRL-896(Pt.II)
269729*	16-24140	OTS
269849*	16-23989	See ZPh-108
269867*	16-23832	OTS
269884*	16-23405	OTS
269975*	16-24178	See WAL-TR-766-3/1-3
269983*	16-23515	OTS
270235*	16-24141	OTS
270550*	16-24881	See AFCRL-1119
270673*	16-24142	OTS
270807*	16-24240	See NARF-61-40T
270903*	16-24912	OTS
271004*	16-24656	See ML-879
271165*	16-24273	See BRL-1152
271370*	16-24086	See ARL-229
271377*	16-24130	OTS
271417*	16-24780	See GA-2783
AE–	(Swedish)	
71	16-24758	Dep.(mc)
75	16-24930	Dep.(mc)
76	16-23662	Dep.(mc)
77	16-24759	Dep.(mc)
AEC-tr–		
4121	16-23718	Dep.; $0.50(OTS)
4139	16-23776	Dep.; $0.90(OTS)
5093	16-23719	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5096	16-24036	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5098	16-23673	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5099	16-23792	Dep.(mc); $2.60(fs), $0.98(mf) JCL or OTS
5116	16-23643	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5120	16-23858	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5141	16-23421	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5143	16-24765	Dep.(mc); $2.60(fs), $0.92(mf) JCL or OTS
5144	16-23720	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5146	16-24766	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5147	16-24245	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5149	16-23721	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5150	16-23722	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5151	16-23723	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5153	16-23724	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5155	16-23725	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5156	16-24767	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5158	16-24768	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5159	16-23990	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5160	16-24799	Dep.(mc); $3.60(fs), $1.31(mf) JCL or OTS
5161	16-25002	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5165	16-24953	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5174	16-24179	Dep.(mc); $3.60(fs), $1.13(mf) JCL or OTS
5175	16-24180	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5177	16-24181	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5178	16-23674	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5189	16-24037	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5190	16-23422	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5191	16-24038	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5198	16-25003	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5203	16-24182	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5204	16-24769	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5206	16-24183	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5213	16-24184	Dep.(mc); $2.60(fs), $1.01(mf) JCL
5215	16-23423	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5235	16-24124	Dep.(mc); $1.60(fs), $0.80(mf) JCL
AECL–	(Canadian)	
1465	16-24009	See CRRIS-1071
1491	16-23842	See CREL-952
1506	16-24235	See CRFD-1084
1516	16-24978	See DL-49
1528	16-24932	See CRRP-1087
1530	16-23843	See CREL-1009)
1532	16-24171	See R61CAP69
1537	16-24779	See CRRP-1090
1540	16-24760	See CRT-1079
AEDC-TDR–	(Non-AEC)	
62-88	16-24879	
AEET/AM–	(Indian)	
24	16-23833	Dep.(mc)
AERE-Bib–	(British)	
140	16-23982	Dep.; $0.35(BIS)
AERE-M–	(British)	
1014	16-23834	Dep.; $0.56(BIS)
AERE-R–	(British)	
3499	16-23596	Dep.; $0.49(BIS)
3696	16-23460	Phys. in Med. Biol. 7: 45-67(1962)
3874	16-23899	IRE Trans. on Nuclear Sci. NS-9, No. 3, 174-80(1962)
3973	16-24143	Dep.; $0.70(BIS)
3974	16-23597	Dep.; $0.16(BIS)
3977	16-23411	Dep.; $0.49(BIS)
4029	16-24270	Dep.; $0.70(BIS)
4035	16-23370	Dep.; $0.35(BIS)
4043	16-24271	Dep.; $0.77(BIS)
4062	16-24144	Dep.; $0.56(BIS)
AERE-Trans–	(British)	
884	16-24185	Dep.
888	16-25004	Dep.
890	16-24869	Dep.
AFCRL–	(Non-AEC)	
896(Pt.II)	16-24880	OTS
1119	16-24881	OTS
AFOSR–	(Misc.)	
1632*	16-25030	
2637*	16-24675	
2665*	16-23835	
AFSWC-TDR–	(Non-AEC)	
62-25	16-23836	
ANL–		
6268	16-24145	Dep.; $1.00(OTS)
6515	16-23963	Dep.; $3.50(OTS)
6519	16-23527	Dep.; $0.75(OTS)
6546	16-23663	Dep.; $0.90(OTS)
6552	16-24964	Dep.; $3.00(OTS)
6561	16-24931	Dep.; $2.75(OTS)
ANL-PGF–		

Report No.	Abstract No.	Availability
296	16-23965	See ANL-6515(p.28-52)
APAE–	**(Misc.)**	
105	16-24965	Dep.; $2.50(OTS)
121	16-24966	Dep.(mc); $1.60(fs), $0.80(mf) OTS
APED–	**(Non-AEC)**	
3959	16-24272	
3960	16-24676	
APEX–		
800(Pt.A)	16-24967	Dep.(mc); $15.00(fs), $7.07(mf) OTS
800(Pt.F)	16-24968	Dep.(mc); $9.10(fs), $3.32(mf) OTS
ARDC-P–	**(British)**	
36	16-23598	Dep.(mc)
ARF–	**(Misc.)**	
2198-28	16-24117	Dep.(mc); $1.60(fs), $0.80(mf) OTS
ARL–	**(Non-AEC)**	
180	16-23599	$1.25(OTS)
229	16-24086	OTS
250	16-24882	
251	16-24883	
62-315	16-23837	OTS
62-343	16-24234	$1.75(OTS)
62-350	16-23707	OTS
AROD–	**(Misc.)**	
2774:2*	16-24660	
ASD-TDR–	**(Non-AEC)**	
62-11	16-24146	OTS
62-90	16-24147	
62-244	16-24903	OTS
62-259	16-24884	OTS
ASD-TR–	**(Non-AEC)**	
61-283	16-24885	OTS
61-625	16-23664	
61-676	16-24148	OTS
AWRE-Trans–	**(British)**	
34	16-23991	Dep.(mc)
BLG–	**(Belgian)**	
69	16-25013	Dep.(mc)
99	16-25014	Dep.(mc)
BLG-B–	**(Belgian)**	
2	16-23665	Dep.(mc)
3	16-23666	Dep.(mc)
BMI-X–		
201	16-24118	Dep.(mc); $3.60(fs), $1.31(mf) OTS
204	16-24149	Dep.(mc); $1.10(fs), $0.80(mf) OTS
BNL–		
705	16-23352	Dep.; $2.00(OTS)
725	16-24087	Dep.; $0.50(OTS)
732	16-24776	Dep.; $0.50(OTS)
737	16-23838	Dep.; $0.50(OTS)
4811	16-23701	Nucleonics 21: No. 3, 53(1962)
4888	16-23397	Proc. Soc. Exptl. Biol. Med. 105: 142-5 (1960)
4931	16-23366	Northwest Med. 59: 1526-32(1960)
4981	16-23452	Intern. J. Radiation Biol. 4: 15-20 (1961)
5032	16-23429	Am. J. Pathol. 38: 599-623(1961)
5377	16-23830	Nucleonics 19, No. 11: 140-4(1961)
5923	16-24860	Phys. Rev. 126: 1882-98(1962)
5993	16-23911	IRE Trans. on Nuclear Sci. NS-9, No. 3, 275-9(1962)
6011	16-23434	Blood 20: 203-13(1962)
6081	16-23428	A.M.A. Arch. Ophthalmol. 67: 163-70(1962)
6101	16-23910	IRE Trans. on Nuclear Sci. NS-9, No. 3, 261-74(1962)
BRL–	**(Misc.)**	
1152*	16-24273	OTS
CEA–	**(French)**	
1774	16-23643	Also issued as AEC-tr-5116
1991	16-23708	Dep.(mc)
1994	16-23371	Dep.(mc)
2082	16-23839	Dep.(mc)
2131	16-23406	Dep.(mc)
2132	16-23412	Dep.(mc)
2136	16-24677	Dep.(mc)
2138	16-23840	
2146	16-24777	Dep.(mc)
2147	16-25034	Dep.(mc)
2148	16-24778	Dep.(mc)
2162	16-23841	Dep.(mc)
3677	16-24179	See AEC-tr-5174
CEA-Bib–	**(French)**	
26	16-24274	Dep.(mc)
CEA-tr–	**(French)**	
A-1002	16-24021	Dep.(mc); $2.60(fs), $0.89(mf) JCL
A-1119	16-23859	Dep.(mc); $3.60(fs), $1.13(mf) JCL
A-1122	16-23860	Dep.(mc); $1.60(fs), $0.80(mf) JCL
A-1126	16-23861	Dep.(mc); $1.60(fs), $0.80(mf) JCL
CEND–	**(Misc.)**	
116	16-24969	Dep.(mc); $5.60(fs), $1.73(mf) OTS
135(Vol.I Suppl.)	16-24970	Dep.(mc); $2.60(fs), $0.95(mf) OTS
150(Pt.I)	16-24971	Dep.; $1.75(OTS)
CERN–	**(European Organization for Nuclear Research)**	
62-3	16-24865	Dep.(mc)
CEX–		
59.4.11	16-23983	Dep.; $1.00(OTS)
CF–	**(Oak Ridge National Lab.)**	
57-2-1(Rev.1)	16-23353	Dep.(mc); $2.60(fs), $1.10(fs) OTS
CLM-R–	**(British)**	
18	16-24275	Dep.; $1.40(BIS)
19	16-24886	Dep.; $0.56(BIS)
CNEN–	**(Italian)**	
113	16-24150	Dep.(mc)
134	16-25015	Dep.(mc)
CNI–	**(Italian)**	
57	16-23600	Dep.(mc)
CREL–	**(Canadian)**	
952	16-23842	Dep.; $1.50(OTS)
1009	16-23843	Dep.; $1.50(AECL)
CRFD–	**(Canadian)**	
1084	16-24235	Dep.; $0.50(AECL)
CRRIS–	**(Canadian)**	
1071	16-24009	Dep.; $1.00(AECL)
CRRP–	**(Canadian)**	
1087	16-24932	Dep.; $1.50(AECL)
1090	16-24779	Dep.; $1.00(AECL)
CRT–	**(Canadian)**	
1079	16-24760	Dep.; $1.50(AECL)
CU–	**(Misc.)**	
7356*	16-24389	See NP-11601
CVNA–	**(Misc.)**	
138	16-24972	Dep.(mc); $6.60(fs), $2.12(mf) OTS
141	16-24973	Dep.(mc); $10.10(fs), $3.95(mf) OTS
D–	**(Misc.)**	
1-82-0170*	16-24887	
DASA–	**(Misc.)**	
1302*	16-23407	
DC–	**(Misc.)**	
55-7-61	16-24974	Dep.(mc); $3.60(fs), $1.28(mf) OTS
60-1-37	16-23801	Dep.(mc); $5.60(fs), $1.79(mf) OTS
60-6-722	16-24933	$5.60(fs), $2.00(mf) OTS
60-10-154	16-24975	Dep.(mc); $1.10(fs), $0.80(mf) OTS
60-10-726	16-24976	Dep.(mc); $3.60(fs), $1.16(mf) OTS
60-11-103	16-24934	Dep.(mc); $1.60(fs), $0.80(mf) OTS
61-2-97	16-24935	Dep.(mc); $5.60(fs), $1.70(mf) OTS
61-2-98	16-24904	Dep.(mc); $13.50(fs), $5.96(mf) OTS
61-2-133	16-24151	Dep.(mc); $2.60(fs), $1.10(mf) OTS
61-6-5	16-23779	Dep.(mc); $1.10(fs), $0.80(mf) OTS
61-6-16	16-24977	$5.60(fs), $1.91(mf) OTS
DL–	**(Non-AEC)**	
49	16-24978	Dep.; $0.50(AECL)
DLCS–		
1470107(Rev.)	16-24979	Dep.(mc); $2.60(fs), $0.89(mf) OTS
5000562	16-24980	Dep.(mc); $5.60(fs), $1.76(mf) OTS

Report No.	Abstract No.	Availability
5020100	16-24010	$12.00(fs), $5.15(mf) OTS
DMIC–	**(Non-AEC)**	
168	16-24096	
DMIC-Memo–	**(Non-AEC)**	
152	16-24131	
154	16-24152	
156	16-24153	
DOFL-TM–	**(Non-AEC)**	
60-27	16-25016	
DP–		
669	16-24236	Dep.; $0.50(OTS)
709	16-24237	Dep.; $0.50(OTS)
711	16-24011	Dep.; $0.50(OTS)
DRI–		
2031	16-24123	See TID-16030
2032	16-24174	See TID-16032
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
DXRL-F–	**(New Zealand)**	
3	16-23408	Dep.(mc)
EP–	**(Misc.)**	
4428-101-62U*	16-24166	See NP-11854
ER–	**(Misc.)**	
270-1F*	16-23836	See AFSWC-TDR-62-25
4809*	16-23670	See NP-11888
EURAEC–		
42	16-23816	Dep.(mc); $16.00(fs), $7.64(mf) OTS
57	16-24097	Dep.(mc); $8.60(fs), $2.93(mf) OTS
184(Pt.II)	16-25046	See TID-7628(p.155-65)
184(Pt.III)	16-25050	See TID-7628(p.198-210)
347	16-24117	See ARF-2198-28
EXP-NRX–	**(Canadian)**	
5806	16-24235	See CRFD-1084
FA-R–	**(Non-AEC)**	
1623	16-24164	See NP-11778
FTD-TT–	**(Non-AEC)**	
62-317	16-24288	OTS
63-530	16-23808	OTS
FZK–	**(Non-AEC)**	
9-169	16-24240	See NARF-61-40T
GA–	**(Misc.)**	
2451(Vol.II)	16-24088	Dep.; $3.00(OTS)
2783*	16-24780	OTS
2824*	16-24276	
3245*	16-24154	
GAMD–	**(Misc.)**	
2221	16-24119	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GEAP–	**(Misc.)**	
3831	16-24107	Dep.; $1.00(OTS)
3875	16-24155	Dep.; $2.50(OTS)
4012	16-24936	Dep.; $0.50(OTS)
GEMP–		
12A	16-24238	Dep.; $0.75(OTS)
113	16-24678	Dep.; $0.75(OTS)
114	16-24089	Dep.; $0.50(OTS)
115	16-24679	Dep.; $0.75(OTS)
116	16-24090	Dep.; $0.50(OTS)
117	16-24091	Dep.; $0.50(OTS)
GNEC–		
198	16-24981	Dep.; $4.00(OTS)
GV–		
298	16-24156	Dep.(mc); $1.60(fs), $0.80(mf) OTS
HASL–		
127	16-24012	Dep.; $3.00(OTS)
HTC–	**(Non-AEC)**	
61-78	16-24178	See WAL-TR-766-3/1-3
HW–		
68021	16-23780	Dep.(mc); $1.60(fs), $0.80(mf) OTS
69225	16-25035	Dep.(mc); $1.10(fs), $0.80(mf) OTS
69677	16-23601	Dep.; $0.50(OTS)
70400	16-24937	Dep.(mc); $1.60(fs), $0.80(mf) OTS
71649	16-24938	$2.60(fs), $0.89(mf) OTS
71684	16-23817	Dep.(mc); $3.60(fs), $1.01(mf) OTS
73211	16-24120	Dep.(mc); $1.10(fs), $0.80(mf) OTS
73366	16-23409	Dep.; $0.75(OTS)
HW-SA–		
2185	16-23618	See TID-7629(p.42-53)
2236	16-25069	See TID-7628(p.491-505)
2251	16-25045	See TID-7628(p.130-44)
2260	16-25042	See TID-7628(p.77-98)
2273	16-25052	See TID-7628(p.214-36)
2458	16-23781	$3.60(fs), $1.19(mf) OTS
2519	16-23398	Proc. Soc. Exptl. Biol. Med. 110: 273-5 (1962)
2547	16-24239	$1.60(fs), $0.80(mf) OTS
2548	16-24939	Dep.(mc); $12.50(fs), $5.45(mf) OTS
HW-tr–		
40	16-23675	Dep.(mc); $8.60(fs), $2.96(mf) JCL or OTS
IA–	**(Non-AEC)**	
639	16-23602	Dep.(mc)
728	16-23667	Dep.(mc)
IC–	**(Canadian)**	
134	16-23604	See NP-11873
IDO–		
11052	16-24940	Dep.(mc); $3.60(fs), $1.28(mf) OTS
11101	16-24941	Dep.(mc); $4.60(fs), $1.49(mf) OTS
14582	16-23782	Dep.; $0.75(OTS)
14584	16-23783	Dep.; $0.50(OTS)
16735	16-24092	Dep.; $1.25(OTS)
16761	16-25017	Dep.; $2.25(OTS)
16769	16-23668	Dep.; $1.00(OTS)
16775	16-24982	Dep.(mc); $0.50(OTS)
19030(Vol.I Suppl.)	16-24970	See CEND-135(Vol.I Suppl.)
19308	16-25021	Dep.; $2.00(OTS)
IS–		
163	16-23645	Chemist Analyst 50: (1961)
222	16-24201	Metals Handbook 1: 8th ed. (1961)
223	16-24114	Metals Handbook 1: 8th ed. (1961)
292	16-24193	J. Appl. Phys. 33: (1962)
349	16-24277	Dep.; $1.25(OTS)
351	16-24108	Dep.; $2.50(OTS)
357	16-24857	Phys. Rev. 126: 1822-5(1962)
448	16-24157	Dep.; $1.50(OTS)
ISS–	**(Italian)**	
61/41	16-24680	Dep.(mc)
JAERI–	**(Japanese)**	
1025	16-25022	
JEN–	**(Spanish)**	
91-DQ/I-25	16-23603	Dep.(mc)
JINR–	**(Russian)**	
D-976	16-24681	Dep.(mc)
P-868	16-24682	Dep.(mc)
P-889	16-24683	Dep.(mc)
P-914	16-24866	Dep.(mc)
P-920	16-24684	Dep.(mc)
P-928	16-24685	Dep.(mc)
P-939	16-24686	Dep.(mc)
P-944	16-24687	Dep.(mc)
P-947	16-24688	Dep.(mc)
P-948	16-24689	Dep.(mc)
P-957	16-23709	Dep.(mc)
P-962	16-24867	Dep.(mc)
P-966	16-24690	Dep.(mc)
P-968	16-24691	Dep.(mc)
P-971	16-24278	Dep.(mc)
P-890	16-24913	Dep.(mc)
P-896	16-24781	Dep.(mc)
P-901	16-24914	Dep.(mc)
P-967	16-24782	Dep.(mc)
P-970	16-24692	Dep.(mc)
JLI–		
650-2-1(Vol.I)	16-23710	Dep.(mc); $2.75(OTS)

Report No.	Abstract No.	Availability
680-2-1(Vol.II)	16-23711	Dep.(mc); $2.25(OTS)
JPL-TR-	(Non-AEC)	
32-232	16-25031	
32-290	16-23818	
34-249	16-24783	
JPRS-	(Non-AEC)	
13639	16-23516	OTS
14324	16-23726	OTS
K-		
1526	16-24158	Dep.; $2.75(OTS)
KAPL-M-		
RPC-4	16-24093	Dep.(mc); $1.60(fs), $0.80(mf) OTS
WAG-1	16-23819	Dep.(mc); $2.60(fs), $0.95(mf) OTS
KR-	(Norwegian)	
18	16-24121	Dep.(mc)
20	16-24942	Dep.(mc)
LA-		
2666	16-24109	Dep.; $1.75(OTS)
LAS-TR-	(Misc.)	
162-25	16-24885	See ASD-TR-61-283
M-	(Misc.)	
295	16-24868	See TID-16053
1826*	16-24162	See NP-11654
MAB-	(Non-AEC)	
110-M(15)	16-24159	
139-M(C4)	16-24110	
134-M	16-24160	
MCW-		
1470	16-23773	Dep.; $1.25(OTS)
MITNE-		
7	16-24941	See IDO-11101
20	16-23791	See TID-16139
ML-	(Misc.)	
879*	16-24656	OTS
MND-C-		
2500-3	16-24943	Dep.(mc); $7.60(fs), $2.51(mf) OTS
2500-4	16-24944	Dep.(mc); $6.60(fs), $2.06(mf) OTS
2500-5	16-24945	Dep.(mc); $3.60(fs), $1.31(mf) OTS
2500-6	16-24094	Dep.(mc); $8.60(fs), $2.93(mf) OTS
MND-M-	(Misc.)	
1866	16-24983	Dep.; $2.75(OTS)
MTI-	(Non-AEC)	
62TR1	16-23805	See TID-15212
62TR2	16-23806	See TID-15295
NAA-SR-		
6891	16-23820	Dep.(mc); $2.60(fs), $0.86(mf) OTS
NAA-SR-Memo-		
4325(Rev.1)	16-24946	Dep.(mc); $1.60(fs), $0.80(mf) OTS
6782	16-24279	Dep.(mc); $2.60(fs), $1.01(mf) OTS
6907	16-24947	Dep.(mc); $2.60(fs), $0.89(mf) OTS
7134	16-24984	Dep.(mc); $5.60(fs), $1.82(mf) OTS
7172	16-24161	Dep.(mc); $3.60(fs), $1.13(mf) OTS
7182	16-23821	Dep.(mc); $1.10(fs), $0.80(mf) OTS
7212	16-24948	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7347	16-24905	Dep.(mc); $3.60(fs), $1.22(mf) OTS
NARF-	(Non-AEC)	
61-40T	16-24240	OTS
NASA-TN-	(Misc.)	
D-1267*	16-24013	$1.25(OTS)
D-1291*	16-24661	$1.00(OTS)
D-1307*	16-24280	$0.50(OTS)
NBS-	(Misc.)	
7244	16-24888	Dep.(mc); $2.60(fs), $1.04(mf) OTS
NDA-	(Misc.)	
2561-1*	16-24985	
NDL-TR-	(Non-AEC)	
20	16-23844	
30	16-24796	See UNC-5002
NEL-LDR-	(Scottish)	
15/60	16-23802	See NP-11683
NP-	(AEC File No. for Non-AEC Reports)	
11538	16-24693	
11601	16-24889	
11612(Vol.II)	16-24915	
11619	16-25032	
11622	16-24784	
11654	16-24162	
11683	16-23802	
11700	16-24122	
11711	16-24163	
11713	16-24132	
11715	16-24014	
11731	16-24694	Dep.(mc)
11734	16-23845	Dep.(mc)
11738	16-24916	
11744	16-23712	Dep.(mc)
11748	16-24785	Dep.(mc)
11757	16-24695	Dep.(mc)
11767	16-23354	Dep.(mc)
11778	16-24164	
11788	16-23713	
11791	16-24786	Dep.(mc)
11793	16-24787	Dep.(mc)
11796	16-24788	
11818	16-23822	
11824	16-24165	
11825	16-24111	
11826	16-23669	Dep.(mc)
11831	16-23823	
11837	16-24220	
11846	16-24281	
11852	16-24241	OTS
11854	16-24166	
11856	16-24242	
11873	16-23604	Dep.(mc); $0.25 as IC-134; Can. Dept. Mines and Tech. Surveys, Ottawa
11874	16-24789	
11877	16-23774	
11880	16-24696	
11888	16-23670	
11899	16-24167	
11906	16-24282	
NP-tr-	(AEC File No. for Non-AEC translations)	
898	16-24289	$1.60(fs), $0.80(mf) JCL or OTS
NRDC-	(British)	
123	16-24790	Dep.(mc)
NRL-	(Misc.)	
5775*	16-23671	
NYO-		
2694	16-24168	Dep.; $1.75(OTS)
7885	16-24283	Dep.(mc); $2.60(fs), $0.98(mf) OTS
8922	16-23984	Dep.(mc); $8.10(fs), $2.63(mf) OTS
9430	16-24169	Dep.(mc); $2.60(fs), $0.95(mf) OTS
9532	16-23985	Dep.(mc); $5.60(fs), $1.82(mf) OTS
9851	16-24035	Dep.(mc); $2.60(fs), $0.89(mf) OTS
9949(Pt.I)	16-24971	See CEND-150(Pt.I)
10023	16-23714	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10132	16-24697	Dep.(mc); $1.60(fs), $0.80(mf) OTS
ORNL-		
2971(Vol.1)	16-23784	Dep.; $3.50(OTS)
2971(Vol.3)	16-23785	Dep.; $2.75(OTS)
3089	16-24791	Dep.; $0.75(OTS)
3224	16-24986	Dep.; $1.00(OTS)
3258	16-24890	Dep.; $0.50(OTS)
3271	16-23786	Dep.; $1.60(fs), $0.80(mf) OTS
3282	16-25023	Dep.; $2.75(OTS)
3285	16-23787	Dep.; $0.50(OTS)
3290	16-23528	Dep.; $2.00(OTS)
3300(Vol.1)	16-23355	Dep.; $2.00(OTS)
3305	16-24792	Dep.; $0.75(OTS)
3310	16-24243	Dep.; $0.75(OTS)
ORNL-TM-		

Report No.	Abstract No.	Availability
86	16-25072	See TID-7628(p.532-5)
108	16-24987	Dep.(nc); $10.10(fs), $3.86(mf) OTS
137	16-23846	Dep.(nc); $2.60(fs), $1.07(mf) OTS
142	16-25070	See TID-7628(p.506-12)
184	16-23788	Dep.(nc); $1.60(fs), $0.80(mf) OTS
189	16-24949	Dep.(nc); $1.60(fs), $0.80(mf) OTS
229	16-24095	Dep.(nc); $4.60(fs), $1.52(mf) OTS
230	16-24674	Dep.(nc); $3.60(fs), $1.16(mf) OTS
241	16-23789	Dep.(nc); $11.50(fs), $4.91(mf) OTS
244	16-23790	Dep.(nc); $1.60(fs), $0.80(mf) OTS
249	16-24170	Dep.(nc); $2.60(fs), $1.07(mf) OTS
250	16-24950	Dep.(nc); $2.60(fs), $1.10(mf) OTS
251	16-24988	Dep.(nc); $6.60(fs), $2.27(mf) OTS
255	16-23775	Dep.(nc); $2.60(fs), $0.89(mf) OTS
260	16-25036	Dep.(nc); $1.60(fs), $0.80(mf) OTS
270	16-23410	Dep.(nc); $1.60(fs), $0.80(mf) OTS
ORO–		
545	16-23986	Dep.; $0.50(OTS)
PAN–	**(Polish)**	
285/ChR	16-23715	Dep.
287/IV	16-23672	Dep.
290/ChR	16-23716	Dep.
291/VI	16-24662	Dep.
PATENTS	**$0.25 each, U. S. Patent Office**	
3,042,486	16-23777	
3,042,595	16-24958	
3,042,598	16-24959	
3,042,600	16-24960	
3,042,601	16-25028	
3,042,802	16-23960	
3,042,803	16-23814	
3,042,830	16-23815	
3,042,855	16-23961	
3,042,856	16-23962	
PG-Report–	**(British)**	
186	16-23605	Dep.; $0.21(BIS)
187	16-23607	Dep.; $0.21(BIS)
188	16-23606	Dep.; $0.21(BIS)
228	16-23608	Dep.; $0.21(BIS)
323	16-23609	Dep.; $0.21(BIS)
335	16-23610	Dep.
342	16-23611	Dep.
344	16-23612	Dep.
PLASTEC-NOTE–	**(Non-AEC)**	
2	16-24112	
PNE–		
106P	16-23356	Dep.; $1.00(OTS)
109F	16-23357	Dep.; $1.50(OTS)
PPAD–		
437E	16-23905	IRE Trans. on Nuclear Sci. NS-9, No. 3, 211-12(1962)
PRDC-TR–		
55	16-24951	Dep.(nc); $2.60(fs), $0.86(mf) OTS
PUC–		
1962-58	16-24753	Phys. Rev. 126: 1875-7(1962)
1962-69	16-23901	IRE Trans. on Nuclear Sci. NS-9, No. 3, 190-9(1962)
R–	**(Misc.)**	
27	16-23816	See EURAEC-42
60GL185	16-23803	Dep.(nc); $3.60(fs), $1.40(mf) OTS
61CAP69*	16-24171	Dep.; $2.00(AECL)
62SD30*	16-24657	
RADC-TN–	**(Non-AEC)**	
61-222	16-24891	OTS
RAI–		
201	16-24698	Dep.(nc); $2.60(fs), $0.95(mf) OTS
RD–	**(Misc.)**	
0100	16-24989	See TID-6702
RFP–		
268	16-24133	Dep.; $0.50(OTS)
RM–	**(Misc.)**	
3105-AEC	16-23804	Dep.(nc); $3.60(fs), $1.34(mf) OTS
RT-EL–	**(Italian)**	
(62)-5	16-23845	See NP-11734
SB–	**(Non-AEC)**	
62-13	16-24241	See NP-11852
SCDC–		
2522	16-23904	IRE Trans. on Nuclear Sci. NS-9, No. 3, 207-10(1962)
SCL-T–		
419	16-23862	Dep.(nc); $1.10(fs), $0.80(mf) JCL
SCTM–		
16-62(11)	16-23847	Dep.(nc); $1.60(fs), $0.80(mf) OTS
326-61(14)	16-23848	Dep.(nc); $2.60(fs), $0.83(mf) OTS
SSC–	**(Non-AEC)**	
137	16-24172	
STI-PUB–	**(International Atomic Energy Agency)**	
20(Vol.I(p.169-78))	16-24038	See AEC-tr-5191
20(Vol.I(p.381-5))	16-24037	See AEC-tr-5189
20(Vol.III)	16-23547	$8.00(IAEA)
21/4	16-24008	$1.50(IAEA)
34(Vol.I(p.103-12))	16-23725	See AEC-tr-5155
34(Vol.I(p.259-76))	16-23723	See AEC-tr-5151
34(Vol.I(p.557-63))	16-24245	See AEC-tr-5147
34(Vol.II)	16-23719	See AEC-tr-5093
34(Vol.II(p.57-67)	16-23990	See AEC-tr-5159
34(Vol.II(p.149-55))	16-23722	See AEC-tr-5150
34(Vol.II(p.183-7))	16-23721	See AEC-tr-5149
34(Vol.II(p.363-9))	16-23720	See AEC-tr-5144
35(p.87-95)	16-24766	See AEC-tr-5146
35(p.259-64)	16-24768	See AEC-tr-5158
35(p.377-94)	16-24765	See AEC-tr-5143
35(p.479-83)	16-24767	See AEC-tr-5156
46(p.397-408)	16-23421	See AEC-tr-5141
46(p.449-59)	16-23422	See AEC-tr-5190
51(Vol.I(p.187-95)	16-25003	See AEC-tr-5198
51(Vol.I(p.353-63)	16-25002	See AEC-tr-5161
21/6	16-24269	$1.50(IAEA)
TCREC-TR–	**(Non-AEC)**	
61-77	16-25029	See AD-269180
TDR–	**(Non-AEC)**	
594(1245-02)TR-1	16-23832	See AD-269867
930(2240-01)-TN-1	16-24140	See AD-269729
TEI–		
811	16-23987	Dep.(nc); $6.60(fs), $2.06(mf) OTS
817	16-23988	Dep.(nc); $4.60(fs), $1.52(mf) OTS
TID–		
3711	16-23358	Free(DTIE)
6702	16-24989	Dep.(nc); $13.50(fs), $6.17(mf) OTS
7025(Vol.I)	16-24990	Dep.; $3.50(OTS)
7025(Vol.II)	16-24991	Dep.; $1.25(OTS)
7025(Vol.III)	16-24992	Dep.; $2.50(OTS)
7025(Vol.IV)	16-24993	Dep.; $2.25(OTS)
7025(Vol.V)	16-24994	Dep.; $1.50(OTS)
7616	16-23372	Dep.; $3.00(OTS)
7628	16-25037	Dep.; $7.00(OTS)
7629	16-23613	Dep.; $4.50(OTS)
12696	16-24793	Dep.(nc); $1.10(fs), $0.80(mf) OTS
14881	16-25024	Dep.(nc); $18.00(fs), $8.81(mf) OTS
15211	16-24794	Dep.(nc); $4.60(fs), $1.67(mf) OTS
15212	16-23805	Dep.(nc); $3.60(fs), $1.22(mf) OTS
15224	16-24995	Dep.(nc); $4.60(fs), $1.49(mf) OTS
15295	16-23806	Dep.(nc); $6.60(fs), $2.12(mf) OTS
15331	16-24795	Dep.(nc); $1.60(fs), $0.80(mf) OTS
15337	16-24134	Dep.(nc); $1.60(fs), $0.80(mf) OTS
15477	16-24996	Dep.(nc); $11.00(fs), $4.70(mf) OTS
15667	16-24761	Dep.(nc); $12.00(fs), $5.06(mf) OTS
15734	16-24997	Dep.(nc); $9.10(fs), $3.38(mf) OTS
15743	16-24762	Dep.(nc); $6.60(fs), $2.15(mf) OTS
15746	16-23849	$3.60(fs), $1.19(mf) OTS
15819	16-24173	Dep.(nc); $2.60(fs), $1.04(mf) OTS
15820	16-24699	Dep.(nc); $6.60(fs), $2.21(mf) OTS

Report No.	Abstract No.	Availability
15913	16-24952	$9.60(fs), $3.68(mf) OTS
15962	16-23413	Dep.(mc); $5.60(fs), $1.76(mf) OTS
15973	16-24284	Dep.(mc); $10.10(fs), $3.86(mf) OTS
15977	16-25025	Dep.(mc); $6.60(fs), $2.06(mf) OTS
15979	16-23807	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15981	16-24244	Dep.(mc); $2.60(fs), $0.83(mf) OTS
15984	16-23414	Dep.(mc); $1.10(fs), $0.80(mf) OTS
15985	16-24015	Dep.(mc); $5.60(fs), $1.91(mf) OTS
16024	16-23529	Dep.(mc); $8.60(fs), $3.20(mf) OTS
16030	16-24123	Dep.(mc); $3.60(fs), $1.16(mf) OTS
16032	16-24174	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16053	16-24868	Dep.(mc); $4.60(fs), $1.61(mf) OTS
16074	16-23850	Dep.(mc); $2.60(fs), $0.92(mf) OTS
16080	16-23415	Dep.(mc); $1.10(fs), $0.80(mf) OTS
16108	16-24700	Dep.(mc); $1.60(fs), $0.80(mf) OTS
16121	16-23416	Dep.(mc); $2.60(fs), $0.89(mf) OTS
16122	16-23417	Dep.(mc); $2.60(fs), $0.86(mf) OTS
16127	16-24285	Dep.(mc); $2.60(fs), $0.83(mf) OTS
16139	16-23791	Dep.(mc); $16.50(fs), $7.73(mf) OTS
16219	16-23418	Dep.(mc); $1.10(fs), $0.80(mf) OTS
TM–	**(Misc.)**	
3413-67*	16-24122	See NP-11700
TMDR–		
609	16-23801	See DC-60-1-37
TO-B–	**(Non-AEC)**	
60-27	16-24014	See NP-11715
TR–	**(Misc.)**	
62-460.1*	16-24163	See NP-11711
TRG-Report–	**(British)**	
229	16-24763	Dep.; $0.49(BIS)
UAC–		
4763	16-23464	Radiology 77: 269-8(1961)
5047	16-24793	See TID-12696
6092	16-23916	IRE Trans. on Nuclear Sci. NS-9, No. 3, 320-6(1962)
6125	16-23923	IRE Trans. on Nuclear Sci. NS-9, No. 3, 366-9(1962)
6130	16-23903	IRE Trans. on Nuclear Sci. NS-9, No. 3, 200-6(1962)
6145	16-23879	IRE Trans. on Nuclear Sci. NS-9, No. 3, 22-7(1962)
UCLA–		
504	16-23642	Dep.(mc); $1.60(fs), $0.80(mf) OTS
UCRL–		
6797	16-24286	Dep.; $0.50(OTS)
6891	16-24287	Dep.; $2.00(OTS)
9214	16-24750	Phys. Rev. 126: 1858-63(1962)
9582	16-24194	J. Inst. of Metals 90: 57-63(1961-62)
9595(Rev.11)	16-24853	Phys. Rev. 126: 1798-1804(1962)
9799	16-23486	p. 277-96 of "Response of the Nervous System to Ionizing Radiation." London, Academic Press, 1962
9950	16-24854	Phys. Rev. 126: 1805-10(1962)
9976	16-23915	IRE Trans. on Nuclear Sci. NS-9, No. 3, 314-19(1962)
9980	16-23893	IRE Trans. on Nuclear Sci. NS-9, No. 3, 118-23(1962)
9982	16-23918	IRE Trans. on Nuclear Sci. NS-9, No. 3, 333-9(1962)
9993	16-24752	Phys. Rev. 126: 1873-5(1962)
10109	16-23851	Dep.; $0.75(OTS)
10116	16-24743	Nuovo cimento (10) 24: 957-62(1962)
10119	16-24175	Dep.; $2.75(OTS)
10126	16-24701	Dep.; $1.00(OTS)
UCRL-Trans–		
399(L)	16-24290	$9.60(fs), $3.77(mf) JCL
796(L)	16-24917	Dep.(mc); $8.10(fs), $2.66(mf) JCL or OTS
816	16-24870	Dep.(mc); $6.60(fs), $2.27(mf) JCL or OTS
828(L)	16-24800	Dep.(mc); $1.60(fs), $0.80(mf) JCL
843	16-24871	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
UNC–	**(Misc.)**	
5002*	16-24796	
UR–		
608	16-23386	Dep.; $5.60(fs), $1.82(mf) OTS
609	16-23419	Dep.; $1.10(fs), $0.80(mf) OTS
611	16-23387	$2.60(fs), $0.86(mf) OTS
USNRDL-TR–	**(Non-AEC)**	
558	16-24906	
561	16-23420	
565	16-23717	
UTIA-TN–	**(Canadian)**	
26	16-23852	
WADC-TR–	**(Misc.)**	
58-266*	16-24797	
WADD-TN–	**(Non-AEC)**	
60-307	16-23853	OTS
WADD-TR–	**(Non-AEC)**	
60-143(Pt.3)	16-24798	OTS
60-749(Pt.2)	16-24176	OTS
60-782(Pt.8)	16-24177	OTS
WAL–	**(Non-AEC)**	
116/4	16-24166	See NP-11854
460.54/1-1	16-24135	
WAL-TR–	**(Non-AEC)**	
766-3/1-3	16-24178	OTS
WAPD-MRP–		
97	16-24998	Dep.; $2.50(OTS)
WAPD-PWR–		
TE-98	16-24999	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TE-99	16-25000	Dep.(mc); $3.60(fs), $1.19(mf) OTS
TE-118	16-25001	Dep.(mc); $1.10(fs), $0.80(mf) OTS
WAPD-T–		
1281	16-24128	Trans. Am. Soc. Metals 55: 77-100(1962)
1464	16-24907	Dep.(mc); $1.60(fs), $0.80(mf) OTS
1497	16-24764	Dep.(mc); $3.60(fs), $1.01(mf) OTS
WSL-TM–	**(British)**	
289	16-23598	See ARDC-F-36
WT–	**(Misc.)**	
360*	16-23359	Dep.(mc); $7.60(fs), $2.33(mf) OTS
543*	16-23854	Dep.(mc); $8.60(fs), $3.14(mf) OTS
544*	16-23855	Dep.(mc); $1.60(fs), $0.80(mf) OTS
789	16-24016	Dep.(mc); $3.60(fs), $1.31(mf) OTS
790	16-23856	Dep.(mc); $10.50(fs), $4.34(mf) OTS
798	16-24017	Dep.(mc); $5.60(fs), $2.00(mf) OTS
1161	16-24018	Dep.(mc); $13.00(fs), $5.63(mf) OTS
1453	16-24019	Dep.; $3.50(OTS)
1454	16-24020	Dep.; $3.50(OTS)
Y–		
1393	16-23857	Dep.; $0.50(OTS)
ZPh–	**(Non-AEC)**	
108	16-23989	OTS

DEPOSITORIES OF USAEC REPORTS

In Countries Other than the U.S.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica
AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission
AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität
BELGIUM
Mol-Donk, Centre d'Etude de l'Energie Nucleaire
BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
São Paulo, Instituto de Energia Atomica, Cidade Universitaria São Paulo
BURMA
Rangoon, Union of Burma Applied Research Institute, Atomic Energy Center Library
CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia
CEYLON
Colombo, University of Ceylon
CHILE
Santiago, Instituto de Fisica y Matematicas, Universidad de Chile
CHINA
Hsinchu, Taiwan, Free China, National Tsing Hua University
COLOMBIA
Bogota, Instituto De Asuntos Nucleares
COSTA RICA
San Pedro, University of Costa Rica Library
DENMARK
Risö, Danish Atomic Energy Commission
DOMINICAN REPUBLIC
Ciudad Trujillo, National Palace
ECUADOR
Quito, Escuela Politécnica Nacional
EGYPT
Cairo, Atomic Energy Commission
EL SALVADOR
San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear
ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
ENGLAND (CONT.)
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library
FINLAND
Helsinki, Teknillisen Korkeakoulun Kirjasto
FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek
GHANA
Accra, University College of Ghana
GREECE
Athens, Greek Atomic Energy Commission
GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear
HAITI
Port au Prince, University of Haiti
HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica
ICELAND
Reykjavik, University of Iceland, Atomic Energy Library
INDIA
Bombay, Department of Atomic Energy
INDONESIA
Bandung, Java, Bandung Institute of Technology
Djogjakarta, Java, Science Faculty, Gadjah Mada University
IRAN
Tehran, Tehran University Center for Nuclear Studies
IRAQ
Baghdad, Iraqi Atomic Energy Commission
IRELAND
Dublin, University College
ISRAEL
Rehovoth, Israel Atomic Energy Commission
ITALY
Casella, Centro di Studi Nucleari di Ispra del C.N.R.N.
Rome, Comitato Nazionale per le Ricerche Nucleari
JAPAN
Tokyo, Science Section, Diet Library
KOREA
Seoul, Office of Atomic Energy
LEBANON
Beirut, American University
LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity
MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear
NETHERLANDS
The Hague, Reactor Centrum Nederland
NEW ZEALAND
Wellington, Department of Scientific and Industrial Research
NORTHERN IRELAND
Belfast, City Library
NORWAY
Lillestöm, Institutt för Atomenergi
PAKISTAN
Lahore, West Pakistan, Atomic Energy Centre
PERU
Lima, Junta de Control de Energia Atomica
PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission
POLAND
Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej
PORTUGAL
Lisbon, Junta de Energia Nuclear
REPUBLIC OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library
REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium
SCOTLAND
Glasgow, Mitchell Library
SPAIN
Madrid, Junta de Energía Nuclear, Bibliotaca Documentación y Publicaciones, Ciudad Universitaria
SWEDEN
Stockholm, Aktiebolaget Atomenergi
SWITZERLAND
Zurich, Institut für Physik, Eidg. Technische Hochschule
THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science
TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library
URUGUAY
Montevideo, Comision Nacional de Energia Atomica
VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Científicas
VIET-NAM
Saigon, Office of Atomic Energy
YUGOSLAVIA
Belgrade, Federal Commission for Nuclear Energy

In International Agencies

AUSTRIA
Vienna, International Atomic Energy Agency

BELGIUM
Brussels, La Bibliotheque EURATOM

FRANCE
Paris, European Nuclear Energy Agency, O.E.C.D.
ITALY
Ispra, EURATOM Research Center

SWITZERLAND
Geneva, United Nations Library
UNITED STATES
Washington, D. C., Inter-American Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

Issue 18B is the
(July-September). Thi
because the material w
in the Annual Index wh
beginning of the reel.

University Micr

he Third Quarter Index
This was not photographed
l will be published again
which is filmed at the
el.

icrofilms, Inc.